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Most Drastic of Government Mandates

THE Fuel Administrator's drastic order has been and will be obeyed. Patriotism, however, should not blind us to the fact that his decree shutting down industry first for a period of five days and then for nine successive Mondays is the most drastic order our Government has ever issued.

While canvass of industries well scattered through the chief industrial section of our country demonstrates willingness to submit to the order, there is far from general agreement as to its probable necessity. Certainly, the way in which it was given out lacked diplomacy and an appreciation of the psychology of the American people. Had the President been chiefly responsible for the order, no such blunder would have been made. He has consummate ability in presenting big situations to the country.

Nevertheless, the effect of the order is so tremendous that the Fuel Administrator must have foreseen the need of making a defense. The fact that he did not do so until the order was issued raised the suspicion that he made the decision without having exhausted all less-drastic alternatives. It now appears that the course adopted had long been under consideration, and that the primary object was to show the country's production and prevent increased seaboard congestion.

While freight congestion, due to lack of shipping, and perhaps to lack of coördination in the handling of shipping, may be the immediate reason for this drastic procedure, in the last analysis the trouble lies with the faulty railroad regulation which for ten years has prevented the expansion of transportation facilities. For this policy the railroad commissions are responsible and beyond them the people themselves.

It is not much consolation at this late date to place the blame squarely, but it may do some good if the public at large is awakened to the true cause for its present suffering. Could this be indelibly impressed upon all voters, there would be less advocacy of the permanent retention of the railroads by the Government.

Centralize the Housing Authority

GOVERNMENT funds for housing war workers have been slow in coming. For months the need has been great, but the voices of the few experts crying in the wilderness have not been able to break down official conservatism at Washington. Now at last the Shipping Board has made the first step and there is hope that the War Department or the Council of National Defense, or whoever is to control the munitions works, will follow its lead. The best results cannot be secured unless the entire housing program is put under one central body composed of experts who, while taking advice as to general needs from the departments concerned, will have the final say as to the design and control of the new towns that must be built. Only in this way can the housing problem be worked out. It has long since passed the stage of a local problem. That it is a part of a stupendous social program is well recognized in the other warring countries, and not to accord such recognition here would be to fail to see beyond the day peace is signed. Diverse authorities cannot be expected to have this broad foresight, but a rightly selected housing commission will have it in large measure, and can in addition be so constituted as to bring to the tasks of immediate construction a much-needed experience in such work.

The Readjustment of Business

THE readjustment of the industrial life of this country to war conditions has been carried out by jerks and starts. Much grinding of machinery and stripping of gears has taken place in the achievement of even such small results as are boasted of by cabinet officers. The real problem has not been so much as stated by the Administration, which has attacked industry as it would a refractory mule, with a club instead of with a bridle. As against the dictum that you *can* run your non-war business without actually breaking the law until the Government finds time to shut you up, we must come to the principle that every patriotic man *must* continue to run his non-war business until the Government can find some way to make use of the investment and labor involved to help win the war. If we are going to win the war, we must keep busy. We must produce faster than any other nation. If the Government is not ready yet to convert even a large fraction of our industry to the production of war exports, because we have no means of transporting them, it is destructive to say, with Doctor Garfield, that *all* production must be curtailed.

It must be realized that the country's economic life, to be healthy, must be uninterrupted. Let us no longer put the question, is so-and-so essential? Let us ask rather, how can we *use* so-and-so to win the war? When these questions are fairly asked by the Administration they will answer themselves. There will be no more rail congestion because the Government is buying things it cannot transport or use. There will be no more rendin

and tearing of the economic structure such as is involved in the present fuel order. For ships will leave our ports fully coaled and laden, munition factories will work at constantly increasing speed, and other plants will produce the maximum quantity of wealth attainable with the remaining labor in order to sustain ourselves and our allies against the day of the triumph of our ideals.

Which Highway Projects Will Receive Federal Aid in 1918?

ON PAGE 163 are the questionnaire and the letter of transmittal sent out to all district engineers by the Office of Public Roads and Rural Engineering. This has been done in order that the distribution of the federal-aid funds during this year may not act to interfere with the progress of the war. But it is more than that, for it is easily conceivable that the funds might be withheld if the capital and man power that is represented by them could be better used. To have decided that highway construction should go on when every ounce of strength should be devoted to the hastening of victory is an acknowledgment that the highway system of the country is of vital importance. It is a recognition on the part of the Government that without roads the transportation network is incomplete.

To many the inevitability of this action has been apparent for some time. When Priority Order No. 2 was issued and it became apparent that its enforcement would mean the discontinuance of all construction work on highways, there was universal protest against its severity. It was felt that not the fullest judgment lay back of an action that threw out of work so many men and left in chaos so much activity that had been started in greatest faith.

Calmer viewing showed the practical necessity of the order, and resulted in a feeling that a slackening of the immediate tension on the railroads would see the resumption of at least the construction that had been started. This hope was justified when, on Jan. 1, all priority orders were revoked, allowing road work to proceed, but under the disadvantages of the closed season. The terms of the revocation were vague, in that they did not guarantee that road materials would be given consideration. The action of the Office of Public Roads comes, therefore, as a welcomed sign that the Government is of the opinion that the highways are necessary to the prosecution of the war, and that new construction is advisable even though the railroads will be forced to carry the burden of the extra traffic, and in spite of the fact that the factories building road machinery might be utilized in the making of munitions.

A resumé of the reasons lying behind this declared attitude of the Government may be interesting and will certainly illuminate the questions of just what part the building of highways and the prosperity of the industries connected with such work has to do with the success of our efforts to bring victory to the banners of the allies. These reasons have generally been condensed into the mere statement that much of the freight congestion with which we are burdened would be lessened if our network of roads were more complete and maintained in a more perfect manner. This is far from the full explanation of the situation, leaving out of account many elements which are as vital as the commonly accepted view and which are in many ways far more cogent and far-reaching.

The classic instance of the use being made of the Cleveland-Akron route is becoming a trifle stale. As an example it is useful, but as a summation of the value of good roads it fails to consider many of the exigencies which the war has forced us to take into account. It fails because it is not even suggestive of the value that good urban streets may have, due to their ability to extend the limits of terminal yards, in allowing trucks to pick up freight at remote switches and deliver it to the store door. When this is taken into account, it is obvious that many of the artificial commercial limitations that we have grown accustomed to will vanish, making shipper and receiver aware of a facility they had not before suspected.

Of course the various state highway officials should not underweigh the fact that new construction practically ruins the value of the route upon which work is being done. In order to avoid this it will be necessary to make a careful study of all available routes in order that new work will interfere the least with such use as is being made at the present time of the roads already in existence. However, this should not be a difficult matter to determine.

Nor should it be forgotten that the scarcity of labor at many points is purely local. Secretary Wilson, of the Department of Labor, has assured us, in a way that does not admit of denial, that there is an adequate labor supply, but places a strong accent on the fact that the matter is one of distribution. Once the truth of this is admitted, it will be seen that our problem at the present moment is to keep all labor occupied at its present tasks until such a time as it is possible to determine where it can be better utilized. Suddenly to cease the construction of roads with the intimation that this order would continue until the close of the war would mean the shutting down of many dependent industries. The result of such an action would be calamitous. Even at the present moment the attitude of labor is none too favorable, and to throw out of work the thousands of skilled mechanics employed in the manufacture of road-building machinery would mean an unsettlement of conditions which would make it difficult to return to normal.

Another factor which is ordinarily overlooked is the 80,000 enemy aliens employed in munitions industries at Cleveland—to cite only one instance. The simple remedy to a situation such as this is to give them employment—under guard, if necessary—on road work, in plants manufacturing paving brick, cement or drain tile, or in quarries where their activities would not interfere directly with the manufacture of materials whose delay in delivery would be an irreparable loss. In work of the sort mentioned there would be but little incentive to destruction, and it is probable that no trouble would be experienced. Labor taken from munition plants and sequestered in work remote from direct connection with the war could be replaced with the more skilled labor which could be withdrawn from these last-mentioned industries.

Nor must it be overlooked or underweighted that the ports are at present overcrowded with munitions for which there are no bottoms. To concentrate blindly on the manufacture of war materials will prove to be an

unwise policy, and hardly calculated to be of any great help in the present crisis.

Without a question the employment of convict labor on highway construction not only is an economy in times of normal prices, but is in line with the most advanced theory of penologists. The main opposition to large-scale experiments in this direction has come from free labor. At the present moment free labor is in such demand that no trouble is to be anticipated, and the experiment can be tried out in a manner which will demonstrate, once and for all, its true value. Taken in connection with enemy alien labor, enough human energy will be available not only to provide roads absolutely needed at the present moment, but to bring our transportation system up to the pitch of efficiency which will be demanded by the post-war certainty of an intensified, international industrial competition.

In conclusion, it is well to remember that many industries which are manufacturing munitions produce, as byproducts, materials which are employed in the construction of the modern highway. If the market for these byproducts is wiped out, the Government must pay higher prices for certain of the materials it needs. As an example of this, toluol and carbolic acid are produced from the distillation of coal tar, the residue of which is the pitch from which so many of the most successful roads are constructed. To a large extent asphalt is the residue from the process by which gasoline is recovered—and while motor cars of the pleasure type can be dispensed with or used to a less extent, it has been found impossible to use any other fuel than gasoline in airplane engines.

Further Shortsightedness Regarding Engineering Education

THE Federal Board for Vocational Education has asked the engineering schools to terminate their present year on April 30 and to devote their equipment and instructional forces until Oct. 1 to the work of training artisans. In normal times, this would mean about two-months' curtailment of the school year. With a great many schools now, however, such a procedure would delay by five months the finishing of all engineering students other than the seniors. Recognizing the Government's need for trained engineers, these colleges are planning to run continuously, thus permitting the four-years' instruction to be compressed within three years. Instead of asking these colleges to depart from this intensive educational plan, it should be the work of some Government agency to urge the schools which have not adopted it to operate without the summer intermission.

If the federal board were able to show that it had exhausted all other means of training the necessary artisans, the engineering profession and the engineering colleges might quickly acquiesce in the proposed scheme. In New York City, at least, the available machinery for the training of artisans has not been exhausted, and unless the board can show that the situation is different in other cities it will with difficulty persuade the engineering profession and the engineering colleges that the intensive training of young men for higher technical work should be curtailed by using the college equipment for five months for an entirely different purpose.

Manifestly, the equipment and organizing ability of the big engineering schools is most attractive to a board casting about for the easiest way to accomplish a big task. If the schools were to be idle, or were not to be devoted to the fulfillment of an urgent war demand, no one would protest against immediate granting of the board's request. As it is, we trust that every engineering society in the country will oppose the plan most vigorously and continue such opposition until the federal board can demonstrate the absolute necessity of the course it has proposed.

Organization To Win the War

THE American people have been spurred on in their work of war preparation during the past year by various slogans. They have been told that "Food will win the war," that "Ships will win the war," that "Bonds will win the war." The revelations made in the investigation by the Senate Committee on Military Affairs during the past weeks prove that above and beyond any of these great needs is the need of "Organization to win the war."

The United States is by far the greatest industrial nation in the world. It has the men; it has the money; it has unlimited raw materials; it has the skill and brains and intelligence and experience necessary to bring all these great forces into harmonious operation to wage effective warfare. The American people have expected and the world has expected that the vast potential power of the United States would be organized for the world conflict with a promptness and thoroughness commensurate with America's reputation for business ability.

Of course it has been well understood that there were many difficulties to overcome, and that time was necessary to create great organizations to carry on the work; but millions of patriotic Americans have thrown every ounce of strength they possessed into war work, and there has been an optimistic belief that all this vast energy and enthusiasm was being efficiently directed and coördinated.

That optimism is at an end. The country is now face to face with the true situation. Senator Chamberlain, chairman of the Senate military committee, at a public meeting in New York on Jan. 19, said: "The military establishment of the United States has fallen down. There is no use in being optimistic about a thing that does not exist. It has almost stopped functioning, my friends. Why? Because of inefficiency in every bureau, in every department of the Government of the United States. America has been groping in the dark for ten months, with able hands but with no head responsible for a war program."

An attempt has been made to break the force of the Senate committee's investigation with the plea that the task of war preparation was so enormous that many blunders were inevitable and that those in charge did as well as anyone could have done. That excuse becomes invalid as one studies the detailed testimony before the Senate committee. Further, that testimony only served to confirm and make public the knowledge possessed by hundreds of business men, manufacturers,

engineers and contractors who have had direct experience of governmental methods during the past year. The public knows, too, that the men who are in the camps have lacked clothing, equipment and arms and that for a long time to come the United States will be unable to supply its troops with artillery, the first essential of present-day warfare.

There is no possible way of making up the time that has been lost. In the present urgent crisis, little time can be given, even, to fixing responsibility for the blunders of the past. Attention is properly concentrated now on the question, how can the present organization—such as it is—be remodeled into an organization competent to utilize the productive forces of America in the broadest way? A bill has been prepared by the Senate military committee, creating a war cabinet of three civilians, to be appointed by the President, and to be men "of demonstrated ability." This war cabinet would have the broad task of planning all operations in connection with the war and seeing to it that interference does not occur between different departments and bureaus. A bill to create a director of munitions, to have charge of the purchase and furnishing of all war supplies, has also been introduced.

The need of somebody with the ability and the authority to plan intelligently and direct in a broad way all the various fields of war effort has long been obvious to every keen observer at Washington. Such a body could not and should not supersede the present organizations in charge of different departments and bureaus, but it should discharge the duties as commander-in-chief of the armed forces of the United States which the Constitution lays upon the President and which he is actually able to discharge in theory only. It could and should, also, supervise and oversee the work of different departments, as the President is personally unable to do, and it should have authority to root out inefficiency and incompetency wherever found, and to inaugurate and compel a go-ahead policy all along the line.

The makeshift organizations with which the Government has been attempting to operate are so obviously ineffective that their failure could have been and in fact was freely predicted months ago. For example, the Administration attempted to secure the aid of experienced business men by creating boards and commissions and committees with merely advisory powers, or with an uncertain division of authority between these bodies and the executive officers with which they are associated. It has relied on the patriotism of these business men to contribute their own services gratis and pay their own expenses, and at one period, even, the expense of carrying on the Government's business. The resulting conflict of authority, friction, confusion and delays which have occurred are what such division of responsibility was bound to produce.

The Government ought, indeed, to summon to its tasks the ablest business men, executives and administrators that can be found, nor should the selection be confined to men of such wealth that they can afford to work for the Government without compensation. Further, these men should be given authority as executives and not as mere advisers, nor should their work be hampered by the official red tape and routine that has so long thwarted able military officers.

The creation of such a war cabinet as the Senate committee proposes is no reflection whatever upon President Wilson nor indeed upon members of his Cabinet. Even under peace conditions these executives have more than they can properly perform. To deal with the huge task of planning and carrying on the war deserves all the strength and energy of three of the ablest men that can be found.

Admittedly, we have been far from attaining efficiency in our governmental operations in time of peace, but we must nevertheless strive to attain it by every means possible in the present emergency, or risk the loss of the cause to which we are committed.

Store-Door Deliveries as a Remedy for Terminal Congestion

THE Highways Transport Committee of the Council of National Defense came before the New York Highway Traffic Association with a clean-cut, precise scheme for the amelioration of the terminal freight congestion existing in that city. Represented by its chairman, Roy D. Chapin, the board attempted to make clear the situation as it existed and to point out in a few words the necessity for a remedy, which to them seemed to lie in a pooling of trucking facilities. They claimed no especial novelty for the plan, mentioning, in fact, that in England no other scheme than "store-door deliveries" was considered practicable or even tolerated under present conditions. As any one who is at all familiar with such proceedings might have expected, their proposal was greeted not with a broad appreciation of its basic merits, but with innumerable objections on the part of this or that interest whose normal method of doing business would be slightly disarranged.

But these objectors, though loud of voice and many in number, all failed to see that the present situation is not one in which individual convenience can be considered, but that rather the point is whether it is not better to put up with a few inconveniences than to be put out of business. They have become so accustomed to doing their various tasks in a certain routine manner that their facility, one is bound to suspect, has become part of their stock in trade—a circumstance that is as essential to their continued success as the actual brains and energy with which they attack new problems. They have taken so many years in learning just how to expedite shipments in the present manner that they count this knowledge as commercial property.

But, unfortunately for these vain protestors, conditions have changed. When only 10% of the time of a freight car is consumed in the actual process of traveling from one point to another, the place to look when seeking efficiency in our transportation system must be at the terminals where much of the 90% is frittered away. When, also, the accustomed methods have been shown to be at fault, attention should be directed not at criticism of proposals that promise relief, but at the devising of better and more efficient plans.

Presumably this attitude of the stand-patter is human and forgivable, but it is to be hoped that the board will not be swayed by the number and noise of their opponents, but only yield ground before a plan so comprehensive and superior that its advantages will be recognized by everyone.

Pneumatic Mixer Train on Mount Royal Tunnel

Keeping Machines Close to Forms Found To Give Best Results After Trying Several Methods in Lining 14,000-Foot Bore

By F. C. K. Stuart
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THE BEST results in placing 64,040 cu.yd. of concrete by the pneumatic method in lining the Mount Royal tunnel were obtained by keeping the mixing plant close to the forms. This eliminated trouble with no plugging the line and made it possible to operate with less compressed air. The plan was finally developed to the point of building a plant on cars which could be moved as the work progressed, and in which the mixer was charged by a skip loaded from a small bin, which in turn was filled by belt conveyors passing beneath bins, mounted on the train, into which the

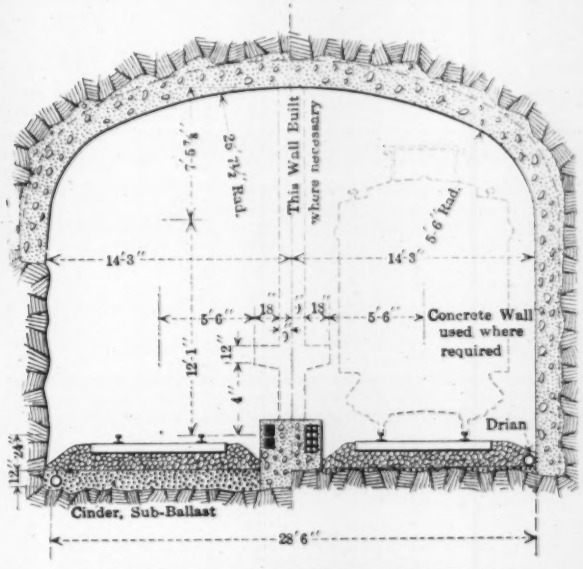
FIRST PLANT WAS STATIONARY

tunnel cars were dumped. These cars were hauled up an incline to the top of the train. This plant, which placed more than 37,000 yd. of concrete in 8 months with 7 sets of forms, not only reduced the delays due to plugs, but effected such a saving in wear on the pipe that it was possible to finish the work without purchasing a large extra quantity.

The pneumatic method was used in placing the greater part of the lining of the tunnel, the work being started in a small way to discover if the system were really economical and could be depended on to work continuously at a fair speed. It was realized that if such results could be obtained, the advantages of the pneumatic over old methods would be considerable. There were two sections of the tunnel to be concreted. In the larger section, which extended east from the west portal for 13,200 ft., the rock was all excavated and trimmed ahead of the concrete work, while in the smaller, which was only 1200 ft. long, the rock was so bad that it had to be taken out in small sections and the concrete placed immediately.

Generally speaking, in the larger section, where the rock sides were sufficiently solid, a hitch, shown on the drawing, was blasted from 3 to 8 ft. below the springing line and the sidewalls placed on this hitch. Where this could not be done the sidewalls were carried down to the floor of the tunnel. In the smaller length, where it was necessary to excavate the upper part of the tunnel and line it before removing the bench, sidewalls 3 or 4 ft. in height were placed directly on the bench. After the roof lining was completed the remaining excavation was carried on very carefully. In spite of this, the rock sidewalls proved so poor that concrete walls had to be put in down to subgrade.

The forms were wooden construction with steel skin plates for the arch form, which was not collapsible. In the longer section of the tunnel they were mounted on carriages running on double-flange wheels with sidewall forms hung from the same carriage. In the short section the arch forms traveled by means of rollers



LINING RESTS ON HITCH IN SIDE WALLS

on skids and the sidewall forms were built after the arch form was set. The forms were designed so that they could be used in sections that were multiples of 5 ft. In general 30-ft. forms were used in the large section and from 5 to 15-ft. lengths in the short.

The company was operating a large crusher plant at the west portal of the tunnel, but this plant was about 16 ft. above the level of the approach cut to the portal and 600 ft. distant. Consequently, additional bins for sand and stone had to be built in the cut

so that the material trains could be loaded in the shortest possible time. The bins were filled from an overhead standard-gage track that connected with the track under the crusher plant. The bins in the cut discharged by swinging gates into the 3-ft. gage tunnel cars directly beneath. All the track in the tunnel was of this gage. Thirty of the tunnel muck cars were converted from end to center dump for use in the material trains. These trains were hauled by standard 10-ton trolley mine locomotives.

In all, three stationary pneumatic plants and one mounted on wheels were used during the course of the work. The first plant was more or less of a crude affair and combined the ideas of the company's engineers and those of J. H. MacMichael of Chicago, who supplied the mixers. The sole idea at first was to keep the mixer supplied with material, as the necessity for a plant that could be easily and quickly moved was not appreciated until later. The first plant was set up on the south side of the tunnel, about 400 ft. east of the first form inside the west portal. This form traveled toward the plant and another was set up directly east

LAST PLANT, MOUNTED ON CARS, KEPT CLOSE TO WORK AND MADE BEST USE OF AIR PRESSURE

of it to travel away from the plant in order to determine how far the concrete could be shot. The mixer was rated at ½-yd. capacity, but was expected to use a two-bag batch of 1:2½:4½ concrete. It was set up as low as possible, the discharge pipe at the bottom resting on the tunnel subgrade. Directly above the mixer was the batch hopper, discharging by a single gate into the mixer, and above this hopper were small storage bins as large as the roof of the tunnel would permit. The sand and stone were supplied to these bins by two bucket elevators fed from two boots under a raised track. The cement was carried up to a platform at the level of the top of the batch hopper by a belt conveyor.

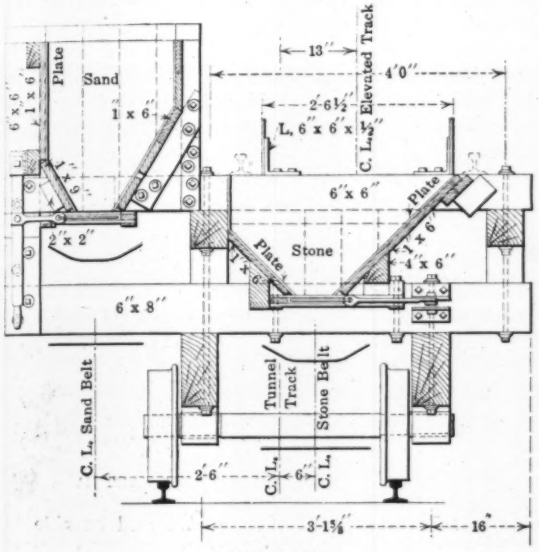
The horizontal discharge pipe, laid directly on the floor of the tunnel, was not fastened down. It was connected to the vertical pipe on the form by two 45-deg. 30-in. radius carbon steel elbows. The vertical pipe was fastened to the bottom chord of the arch form by chains and stiffened by a long knee-brace to the horizontal pipe. At the top were two more 45-deg. elbows to carry the concrete horizontally into the form. The joint between the top elbows and the vertical pipe was made to swivel, so that concrete could be directed to any place in the form. The concrete was carried as far back as desired by using nipples from 2 to 8 ft. long bolted to the last elbow.

First the sidewalls were built up as evenly as possible until the concrete was a foot below the top of the arch form. The mix was then dried a good deal and the arch built up from the back of the form. With a good deflector on the end of the discharge nipple and a proper mixture the concrete could be placed in almost any spot desired. Occasionally a little shoveling was necessary to fill up some awkward place. The form was bulkheaded except for about 13 ft. at the top in front, where the pipe went in. This space was bulkheaded with sand bags as the arch was built up.

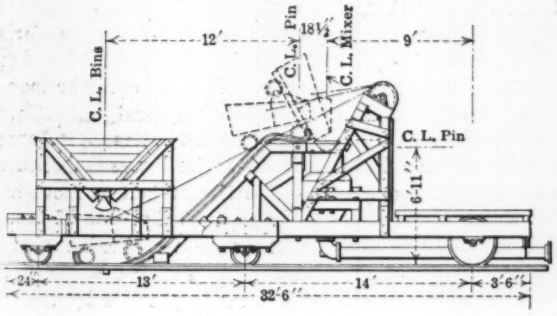
After a good deal of experimenting with the first plant it could be depended on to shoot a one-bag batch and very occasionally a two-bag batch. The latter generally caused a plug in the pipe. The trouble was that the single gate from the batch hopper allowed no control of the manner in which the material entered

the mixer, and the water-measuring device also contributed to the difficulty because it was not possible to discharge water into the mixer exactly with the material, nor to properly control the duration of flow.

Work in the shorter section of the tunnel had to be started before the first plant had finished the work to be done at its first set-up. The shorter section had to be lined more slowly, so that a new type of plant was designed without any bins over the mixer, thus doing away with all the elevators and conveyors and making the plant much more portable. This mixer

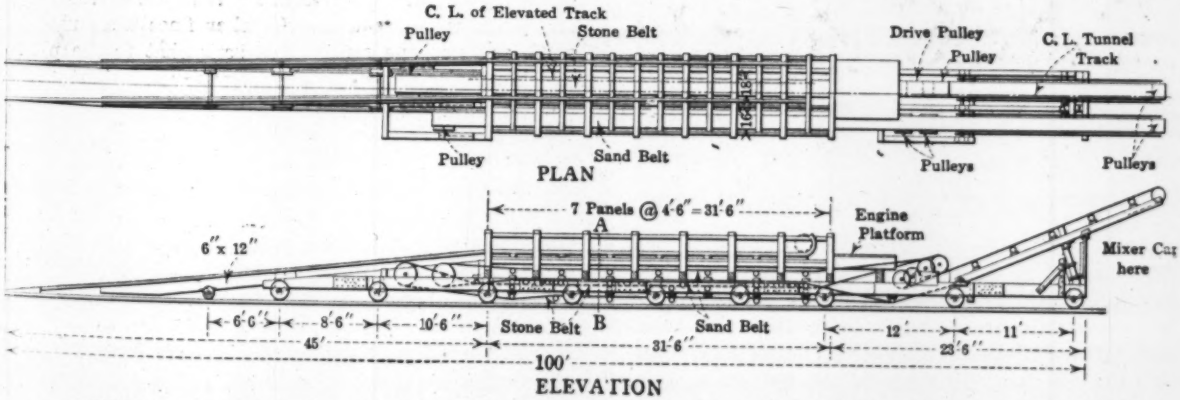


SECTION A-B



was rated at ¼ yd., but all calculations were based on a one-bag batch. The mixer was charged by means of a small shuttle car with a separate partition for sand and stone. This car was moved up and down from beneath the material track to dumping position over the mixer by a single-drum hoisting engine. The discharge end of the car was hooded, and the partition made movable so that the flow of sand and stone could be regulated and the aggregates mixed as they were discharged into the mixer. The car was loaded from two small bins built into the trestle that carried the material trains. The cement was brought in on the same track as the other materials and was unloaded and stored on a platform level with the top of the mixer. From here it was fed as required by means of a short chute into the shuttle car. After properly adjusting the partition in the shuttle car and determining the water feed, the second plant was found to be very successful. The mixer could be run steadily at the rate of two batches a minute provided the material supply could be maintained. This, however, was difficult to accomplish because the haul was two miles in from the crusher plant. Due to the care taken in putting the aggregates into the mixer there were remarkably few plugs in the pipe. The sand, stone and cement were roughly mixed together on entering the machine to give the best results, and the water started to flow an instant ahead of material, continuing in a steady stream until a few seconds after the charge was in the mixer.

The third plant had all the features of the second, except that its mixer was ½-yd., or two-bag-batch capacity. It was first set up 800 ft. east of the first plant, which was abandoned as soon as the work to be done in the first section was completed and the third plant ready for operation. During the first week the third plant could only be worked with a one-bag batch, but after spending that time in experimenting, a two-bag batch was generally used. When the air pressure got below 70 lb., plugs in the pipe were frequent. It was also impossible to use a two-bag dry mix, such as was required to build up the arch, without continuous plugs, so that when the filling of the form had progressed that far a one-bag batch was used to complete the section. Working continuously from Oct. 9, 1915, to May 1, 1916, this plant placed about 18,100 yd. of concrete. The best month was March, in which 4170 yd. was placed in two shifts, using five sets of forms. The force



CARS RAN UP ON ELEVATED TRACK, SIDE DUMP DISCHARGING SAND AND BOTTOM DUMP STONE INTO BINS FROM WHICH TWO CONVEYORS TOOK MATERIAL TO HOPPER OR MIXER; CAR WHICH LOADED CHARGING SKIP

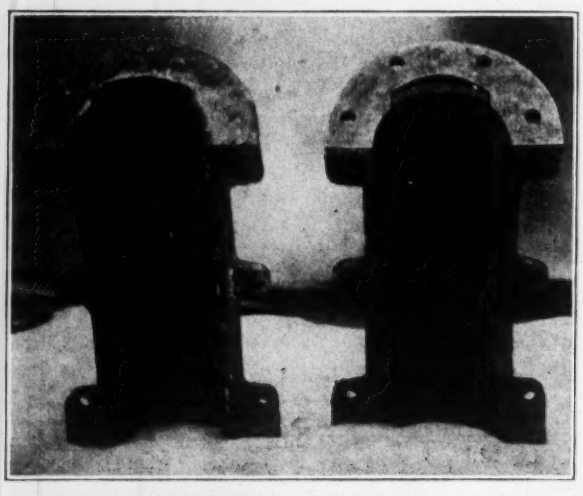
employed in mixing and placing concrete was seven men on the mixer plant, including a hoist runner and the mixer operator, three men on the forms, and part of the time two carpenter helpers looking after leaks in the forms.

The maximum distance between the mixer and the forms of this plant was 1200 ft. This occurred in concreting the section to which the mixer plant was to be moved. Except for this one case, the distance concrete was shot was generally not over 600 ft.

In January, 1916, it was realized that if the work was continued in this way all the pipe on the job would be worn out before completing the lining. The difficulty in maintaining sufficient air pressure for the long shots was expected to increase rapidly as the work advanced further and further from the compressor plant. The remedy for both these difficulties was to build a mixer plant on wheels that could be moved from one form to another, making it possible to operate with a maximum length of pipe between 60 and 100 ft., and with a great saving in compressed air and increased speed of operation. The time taken for one batch to travel out of the mixer, down 1200 ft. of pipe and into the form varied from 40 sec. to 1 min.

The design of such a plant presented numerous difficulties, especially as it was thought best to build it for 3-ft. gage track so that the plant itself could travel on the material track laid in the center of the tunnel. The height of the plant was governed by the headroom under the forms, which was about 12 ft. from the top of rail.

The mixing plant designed to meet these conditions is shown in the drawings and photographs, and incorporates the ideas that worked well in the second and third plants. The hoist for the shuttle car is not shown in the drawing, but was placed on the platform to the

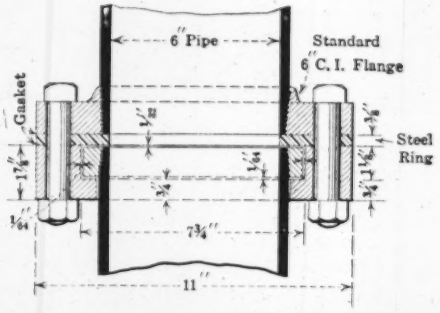


LINING PLATES SAVED REPLACEMENT TIME

right of the mixer. In front of the mixer car was a car about 18 ft. long which carried an air receiver of 158 cu.ft. capacity and the discharge pipe. This pipe was hung below the receiver car, giving two lengths from the bottom elbow of the mixer to the bottom elbow of the vertical pipe. This proved insufficient, so another length of pipe was added which was carried on a pony truck fastened ahead of the receiver car.

The photograph shows the plant in the tunnel with the mixer car in the left foreground. Behind the mixer car is the inclined conveyor car, so called for want of a better name. The material trains were run up this incline into the top of the conveyor car, the stone cars, being center dump, and the sand cars side dump, discharging into small boots with sliding gates from which the material was fed to a pair of belt conveyors. These conveyors carried the stone and sand to the small bins on the mixer car. The drawing shows a section through one of the six boots and a side elevation of the car. Cement was unloaded and stored on the small platforms above the ends of the belt conveyors and dumped through a small chute into the shuttle car as required.

The plant worked very well, the chief drawback being the stub end to the material track. However, there was



SWIVEL JOINT WAS IMPORTANT FACTOR

no way to overcome this difficulty and still be able to work the plant under any conditions among the forms.

Although it was planned to space the forms about 200 ft. apart and move them all in the same direction, the trimming being carried on just ahead of the concreting delayed the work more or less, and the forms were moved in a haphazard way from week to week as the trimming progressed. The plant could be moved fairly readily, as the track was all straight. It was found that the 40-lb. rail with 5-ft. ties 3 ft. apart was really too light, and 60-lb. rail was substituted as the work progressed. The time taken to move and set up averaged about 2½ hours, but the time of breaking and connecting the track to the incline always seemed unnecessarily long.

Even with the short shots made possible by the use of this plant, the air pressure was at times very poor and plugs were frequent. Crusher fines were used as sand, and perhaps contributed somewhat to the plugs, which occasionally occurred even with good air pressure and a reliable operator. The traveling mixer plant placed about 37,265 yd. of concrete in 8 months with 7 sets of forms, the best month being October, when 5811 yd. were placed, and the lowest May, when but 3410 yd. were put in. This was the first month the plant was operated. It worked two shifts, and the average force for one shift in the tunnel on concrete work was a foreman, a mixer operator, a hoist runner, thirteen laborers, three dinkey runners, three brakemen, one pipe fitter and one handy man. The carpenters worked one shift.

Generally speaking, the performance of the mixers was satisfactory after it was realized that though the

machine was apparently simple there were a few small mechanical details which were absolutely essential to economical and fairly continuous operation. The chief of these were the swivel joint just below the top elbow and the use of reliable elbows. The swivel joint itself is very simple, and is shown in one of the drawings. The elbow at the bottom of the mixer was also made so that it swung in any direction, but this feature was not so important after the traveling plant was adopted.

The pipe used was 8-in. mild steel that had been employed previously as an air line. This pipe had plain ends for Dresser joints, and these joints were used. However, they were not considered to have enough strength to resist the pull of the concrete through the pipe, and were reinforced by fastening two angles to each end of each section of the pipe and connecting angles by a pair of ¾-in. machine bolts. At the commencement of the work ordinary cast steel elbows were supplied by the agent of the firm which furnished the mixers. They proved very unreliable, one elbow standing up for 1000 yd. and another one for less than 100 yd. When a blowout occurred it was sometimes possible to put on a patch to last until the form was finished, but in a great many cases it was necessary to take down the elbow and replace it, wasting a good deal of time.

The first improvement made was to get some split elbows, the idea being that as the backs alone wore out they could be replaced with little more than half the trouble required in removing the whole elbow. Four split elbows of manganese steel were ordered for trial, but it was found that under the same conditions the manganese steel only wore 50% longer, while the cost was four times that of the old carbon steel elbows. The old elbows wore out only in one place, so that it was believed the most economical proposition would be to split a few carbon steel elbows with reliable backs, and use reliners consisting of blocks that could be replaced as soon as worn out, as shown in one of the photographs. With an elbow of this type and with proper inspection there should be no delays in concrete work of this character. Fifteen 45-deg. elbows of this type were ordered and reliners of various material, including cast iron, cast steel, manganese steel and ferralun, were procured for trial. Pure rubber in the shape of old sections of motor truck tires was tried, but could not be held in place in the elbow. The most economical lining was found to be cast iron, though ferralun outlasted all the other materials.

This elbow was a great improvement and was used for the rest of the job. It gave very satisfactory service, though after being relined several times the block reliners had a tendency to blow out owing to wear of the elbow itself alongside the liners. When the elbow reached this stage a forged reliner in one piece was put in to fill up all the worn spots. This type of elbow has since been patented and considerably improved. It is now being experimented with on other work.

The pipe wear was considerable, but no figures are available as to the amount actually destroyed. Most of the wear occurred at the ends, and when a length was worn through the ends were cut off and the pipe used again until entirely worn out. The reinforced Dresser joints gave satisfactory service, but there were occasional blowouts due to bad plugs. Where the end of the horizontal pipe connected to the mixer elbow and to the elbow at the bottom of the vertical pipe, a flange was screwed on the pipe.

The compressor plants available had a capacity far above the rated requirements for the mixers, but unfortunately there were so many drills and pumps run from the same air line that it was impossible to tell exactly the amount of air that the mixers used. The quantity was above 1100-cu.ft. per minute, and the mixer would not operate without danger of plugging if the pressure dropped below 70 lb.

The work was designed and executed by the Mount Royal Tunnel and Terminal Co., for which S. P. Brown was chief engineer; W. C. Lancaster, electrical and mechanical engineer; Richard Byers, general superintendent; R. T. Gent, master mechanic and electrician; W. E. Joyce, engineer of design, and the writer, principal assistant engineer.

Use of Self-Healing Coating on New York Central Bridges

PLASTIC "self-healing" coating has been used for the protection of bridge steel over tracks by the New York Central R.R. for five years past. This is the material now being used by the Santa Fe, as reported on p. 888, Nov. 8, 1917. The first application on the New York Central was made in 1912, we are informed by A. W. Carpenter, assistant valuation engineer. Prior to this, however, test exposures had been made in a tunnel. After four years exposure, full protection was still obtained; but, as the specimens were hung along the side of the tunnel, they were not subjected to the direct action of the locomotive blast.

Since 1912 the material has been used quite extensively by the maintenance-of-way department of the company for protecting iron and steel structures over steam-operated tracks, and for protecting the exposed surfaces of steel floor troughs and floor plates.

From some divisions of the railroad good results are reported, and the use of this coating has been continued from year to year. During the past year one particular division applied the coating to no less than twelve steel structures. On one division, however, the material failed to protect the steel against locomotive blast and gases on three structures located over tracks where the clearance above rails averaged 16 to 19 ft. It is believed that this low height is the cause of the failure of the material, as most of the overhead structures on other divisions where favorable results were obtained have clearances of 21 to 22 ft.

Four Municipal Offices Combined in One

Following a legislative amendment to the charter of Middletown, Conn., the offices of director of public works, city engineer, superintendent of streets and sewers, and building inspector have been combined in one under the title of director of public works. The director is continued in service until dismissed by a two-thirds vote of the common council. The office is now filled by C. A. Campbell, who had served for a short time as city engineer and building inspector.

Engineering Council Urges Federal Water-Power Legislation

Cheap and Self-Renewing Power, with Resultant Conservation of Coal, More Important Than Minute Control of Profits, Calvert Townley Tells National Chamber of Commerce

THE Chamber of Commerce of the United States recently invited the Engineering Council to present a statement before its special Water-Power Committee, which is considering the subject of needed Federal legislation for water-power development. The Council delegated Calvert Townley, M. Inst. Elec. E., one of its members, to appear before the Committee as representing the Council. The following is taken from Mr. Townley's statement:

It is my pleasant duty to appear before you by vote of the executive committee of the Engineering Council, in response to your kind invitation of Jan. 10. As the Engineering Council is empowered to speak for the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers on matters of common concern to all of these bodies, the Engineering Council's official utterances concern only such underlying principles and economic facts as are indorsed by all engineers and beyond the field of controversy. These societies are scientific and professional. They, therefore, refrain from expressing views on legal, political and commercial questions except when such are closely linked with essential engineering facts.

It has been estimated by a careful engineer that in 1911 there was over 26,000,000 steam engine horsepower capacity in use (including railroad locomotives), in the United States. The aggregate water horsepower, both developed and undeveloped, has been computed as around 60,000,000. Of this latter the U. S. census of 1912 gives 4,870,000 as developed, and in a report of January, 1916, the Secretary of Agriculture estimated this total to have been increased to 6,500,000. Some of the undeveloped power sites are too remote from any market to be now utilized, and an uncertain number are not commercial prospects; but even so it is clear that the possibilities of additional development are very great.

High Cost of Water Power

There are two fundamental causes which have militated against the substitution of hydro-electric for steam-electric power. One is economic and permanent; the other is statutory and therefore subject to modification. The economic and permanent reason is high cost of development, due to natural conditions. Electric power generated by falling water is inferior to that generated by steam in every particular except cost and, therefore, water-driven service must be cheaper than steam-driven in order to justify its existence. The price for service depends primarily on cost, and cost divides itself naturally into two main items—namely, operation (including maintenance) and fixed charges. As a hydro-electric plant consumes no fuel, its operating cost is less than that of an equivalent steam-driven plant. On the other hand, a steam plant costs usually only from one-fifth to one-half as much per unit of capacity as a hydro-electric plant, so the latter must carry very much heavier fixed charges.

This disability of water service is usually even greater than the ratio of the costs of two equivalent complete developments. A power enterprise seldom comes into being with a market for its entire ultimate output. Therefore, when steam is to be the motive power, only such capacity is installed as initial demands require, and the cost per unit is fairly proportional to that of the ultimate development. In a water development, on the contrary, a large part of the cost is for riparian rights, for the dam, impounding reservoir, flume, forebay, etc., and for the transmission right-of-way, towers, etc., which must be, at the start, provided in large part, and constructed for the complete installation. The obvious result is a greater fixed charge per unit of capacity and a higher cost per horsepower delivered for sale.

In forecasting the commercial prospects of a power enterprise, the possible market must be studied, and, of course, a sale price for power decided upon. As this price is controlled by the cost of similar service from other sources, usually from steam, and as it must be attractive from the start, the additional burden of fixed charges on the initial part of a hydro-electric installation frequently forces the sale of its power below cost. The projectors of the enterprise then must rely for success on a sufficient subsequent increase in their markets. The possibility of an incorrect forecast of the extent of such increase and of the time when it may come imposes a serious business hazard against water and in favor of steam.

Rising Cost of Coal Offset by Increased Efficiency of Steam Power

It has been frequently pointed out that as the nation's coal supply is depleted the cost of coal must rise, thus increasing the cost of steam-electric power as a competitor and raising the market value of hydro-electric power accordingly. The rising price of coal is a matter of record, but it is not so generally known that the improved efficiency of steam-producing machinery (boilers, engines, generators and auxiliaries) has more than kept pace, so that the net cost of producing electric power from coal has steadily declined. As applied to the pre-war period, it may be stated that over a period of ten years the cost of coal has risen on an average 1% per year, while the cost of electric power produced from coal has fallen on an average 2½% per year.

In addition to these facts—still referring to pre-war conditions—the cost of steam-electric generating equipment has been greatly reduced. This fact is due partly to the introduction and subsequent improvement of the steam turbine, and in part to the great increase in the size of the units now available. There is nothing to indicate that the limit of improvement in the design of steam prime movers has been reached or is even in

sight. It is, therefore, a reasonable assumption that further advances in the art will continue to occur and to cut down both the fixed charges and the operating cost of steam power as a competitor of water.

The largest modern steam turbine has now some 12 times the capacity which the largest reciprocating engine had 15 years ago. Stated in another way, the cost of a steam-electric plant per unit of capacity just before the war was about one-third what it was 15 years earlier, while the energy it produces per pound of coal has increased 50 per cent.

Obviously many water-power sites which 15 years ago might have been developed to sell energy in successful competition with steam at its cost then could not now be so developed, and in consequence their development is no longer commercially possible.

An Example of Steam Power Competition

The cost of producing power from either water or steam is a function of the load. Fixed charges remain practically unchanged in both instances whether the output in energy be large or small; but with a steam plant increased output means increased fuel consumption, while a water plant operates either with or without load with but little variation in expense. To illustrate by a concrete example representing not unusual conditions, suppose we assume a steam plant using 2½ lb. of coal per kilowatt-hour at a price of $3 per short ton and having a plant or output factor of 35%—that is to say, an output equal to 35% of its theoretical output if every unit were loaded to capacity 24 hours each day of the year. Under these assumptions the cost of fuel per unit of installed capacity per year would be $11.50, and if the other operating and maintenance charge be assumed to offset fairly those of a water installation of equivalent size, $11.50 represents the additional fixed charges which the hydro-electric plant could carry, and produce power at an equal cost. If therefore the fixed charges (interest, taxes, insurance and amortization) total 11.1½%, the hydro-electric investment per kilowatt capacity could exceed that of steam by $100.

This is not an abnormal excess. Many hydro-electric developments exceed the cost of equivalent steam-driven systems by much greater amounts, in which cases they become commercial prospects only if coal be more expensive per unit of output, or the plant factor be higher, or some other operating or maintenance condition be more favorable.

Further, as has been previously stated, hydro-electric power is inferior to steam-electric power. The reasons are elementary. Stream flow is subject to seasonal variation, and therefore to complete or partial interruption by drought in summer and by ice in winter. Floods are a menace. Long transmission lines may be broken by wind or sleet, or the service may be disarranged by lightning. The losses on such lines vary with load, and are frequently responsible for annoying pressure variations. For these and other reasons, hydro-electric power cannot prevail against steam competition at the same or a slightly lower price. It must be materially lower.

We do not mean to imply that water power may not be a commercially practicable competitor of steam. Many successful hydro-electric installations give substantial proof to the contrary. We do wish, however, to combat most emphatically the widely held but mistaken view that any water-driven plant will produce power at lower cost than steam can and that the margin is so large that investors generally are eagerly seeking a chance to put money into hydro-electric projects. The most careful investigation, frequently demanding substantial expenditure and the keenest scrutiny by experts, is needed to discriminate between worthy and commercially impracticable projects, and the difference is often so small that the imposition of even what seem to be minor burdens is sufficient to turn the scale in favor of steam and entirely prevent what might otherwise be a desirable hydro-electric development.

The second condition which vitally affects development is statutory. Of the estimated 55,000,000 undeveloped water horsepower in the entire country, approximately 40,000,000 is located in 13 Western states, where the Federal Government still owns 760,000,000 acres of land, or over two-thirds of the aggregate area. In order to develop power in that section it is therefore nearly always necessary to use some part of this public domain—if not for the dam site itself at least for flowage, for transmission right-of-way or for some other purpose. Existing law forbids such use except under permit issued by the Secretary of the Interior and revocable without cause, at any time, by himself or his successor in office. It was once believed that revocation would only follow gross abuse well established by evidence, but the drastic action of a one-time Secretary of the Interior some years ago disabused investors of this confidence and demonstrated by a sad object lesson the insecure tenure afforded by existing law. The unfortunate—almost disastrous—result has been practical stagnation in water-power development for many years.

Many available power sites not in the Western states, or not on the public domain, are on navigable streams. For each such project a special act of Congress is necessary. The difficulty of obtaining suitable rights by this means has been found so very great as largely to discourage, even if not to prevent entirely, the developments affected.

Pending Water Power Bills

The several remedial laws recently considered by Congress recognize the essential facts and agree that the remedy is a new law containing the following provisions, namely: An indeterminate permit irrevocable during 50 years, except for cause judicially determined, and continuing thereafter unless and until the Federal Government either renews its permit on mutually agreeable terms, or for itself or through a new permittee takes over at its fair value the hydraulic works and certain other parts of the development.

The Engineering Council does not consider itself expert in legal matters and will not undertake to discuss the relative merits of the different plans. It should be pointed out, however, that a hydro-electric enterprise being once successfully established, it is alike to the interest of the owners, of the Government and of the public that it should continue indefinitely without interruption. There is no economic reason to be served by a cessation, and the only reasons for providing a

legal means of recapturing the installation and the water rights are, first, to preserve an additional measure of Government control against possible abuse by the permittee, and, second, against a remote contingency which might make it desirable that the Government would want to use the power for some other purpose.

DIFFICULTIES IN PROVISION FOR RECAPTURE

A successful power enterprise at the end of 50 years will have multiplied the capacity of its initial installation many times, variously estimated at from five to twenty. In doing so it is almost certain that not only will the entire power available at the original site be fully developed, but other powers as well, which latter may or may not be dependent upon Government permits. Still further, in nearly all cases steam plants as well as water plants are necessary. These steam plants are necessary to supplement hydro-electric power at periods of low water and in case of interruption, as well as, in some instances, to provide increased capacity. In fact, modern practice is rapidly approaching the point of providing steam capacity equal to 100% of hydro-electric for the purposes stated. In any event, the growth of the enterprise over a term of years will be continuous and progressive. There will never come a time when it may be said to have been completed and subject to no further expansion. This continuing growth makes burdensome and usually abortive any attempt to amortize the investment, while the investment in other water powers or in steam plants or both, interconnected with and generally dependent for their economic operation on the original development, renders the right to recapture that development only very onerous and makes it one which constitutes a serious impediment to the free and full development of an enterprise otherwise most desirable from all standpoints.

With respect to power sites on the public domain and on navigable streams the Government is in the position of seeking to have its resources developed without assuming any business hazard and without contributing either capital or credit. It would be unfortunate, in the light of past experience, if any new laws which may be enacted should put the Government in the position of bargaining with capital and of offering just sufficient incentive not to induce capital to undertake the developments desired, thereby, while apparently providing a remedy, in reality insuring a continuance of the present undesirable condition.

Hydro-electric enterprises must compete with the demands of other industries for capital. Experience has shown that even without the imposition of additional financial burdens many of them are not sufficiently attractive to secure development, and as the attractive prospects grade by imperceptible degrees into the unattractive ones, it is perhaps self-evident that every additional burden, however small, transfers a percentage of such projects from commercial into uncommercial prospects.

It is our belief that the benefits afforded the communities served by cheap power, and to the nation by the conservation of coal resulting from the substitution of a self-renewing for a non-renewable natural resource, are far more valuable than is the exact solution of the question of restricting the returns to capital to their irreducible minimum.

Study Urged in Design of Small Coaling Stations

Storage Capacity, W. T. Krausch Says, Must Be Full Carload To Avoid Holding Cars—Various Types of Machinery in Use

ECONOMICAL operation of small coaling stations is a problem which needs more study in their design and equipment, according to a paper read recently before the Western Railway Club by W. T. Krausch, engineer of buildings of the Chicago, Burlington & Quincy R.R. Stations handling 10 to 30 tons per day were referred to particularly. While this amount is small, said Mr. Krausch, the receiving pocket and storage bin must have sufficient capacity for a full carload in order to avoid detaining cars for unloading. Thus economy in transporting and delivering coal involves high first cost of the coaling station, since the capacity must be greater than would be needed otherwise. This will result in a high cost of labor, unless the operator can be utilized to advantage on other work.

As to relative cost and capacity of unloading cars by dumping and shoveling, it is estimated that one man can unload a 50-ton drop-bottom car in about 30 minutes. But he can shovel coal out of a gondola car only at an average rate of 25 tons per 10-hour day. These estimates are based on run-of-mine bituminous coal.

For handling storage coal different methods are available, the selection depending largely upon the capacity and local conditions. Most coaling stations have elevated bins with gravity discharge. For direct loading of the bins or pockets by coal cars, the cars may be raised on incline trestles, the maximum grade being about 5% where they are pushed by locomotives, or 20 to 25% when they are handled by a cable and hoisting engine. The latter is the safer, involves less switching and requires less space.

CONVEYORS USED MAINLY

More generally the coal is dumped from cars into a hopper beneath a track at the ground level and is transferred to the elevated bin by mechanical means. Bucket elevating conveyors, composed of endless chains of small buckets, are used largely and can be adapted to almost all conditions. The elevator may be of the continuous and overlapping bucket type, or of the pivoted bucket type. Both are run at slow speeds, the former on account of its great capacity and the latter on account of the methods of loading and dumping.

Belt conveyors have been used successfully in many plants. Coal unloaded from cars into a receiving hopper is fed by a loader to the belt, which elevates it to the storage bin. The belts may be of rubber or cotton, and the maximum inclination is about 30 degrees.

Elevators having one or two large buckets, of one-ton capacity or over, represent a recent type, which Mr. Krausch states is gradually coming into use on account of its simplicity and its low maintenance cost. In this case also the coal is delivered from cars to a track hopper. From this it is loaded automatically into the bucket, the feed being cut off when the charge is complete. The bucket is then raised and dumped. Two buckets may be worked together, one ascending while

the other descends. With the single-bucket arrangement the capacity of plant may be increased by adding separate units.

Power Plants Use Grab Buckets

A type of plant employed more at commercial plants and power houses than at railway coaling stations utilizes large clamshell buckets which are loaded in the track pit, raised in an elevator leg and then automatically locked to a trolley running on an inclined track leading over the storage bin. At railway terminals, locomotive cranes with grab buckets are sometimes employed to load the tenders with coal taken from a stock pile or directly from cars. When not engaged in coaling engines the crane can transfer coal from cars to storage bins, handle sand, load cinders into cars and do other work about the terminal.

Factors important in reducing the cost of operation and maintenance of coaling stations include the following: Selection of the type of station suited to the local requirements; use of self-cleaning cars; provision for emergency storage; reliability of mechanical equipment, with possible duplication of machinery where delays would be serious; fireproof construction of steel, reinforced-concrete or both in combination; fire protection for frame stations, with power plant built at a distance; minimum amount of switching by locomotives, using car-pullers to reduce this work; good labor and proper supervision of operation; careful maintenance and inspection, with provision for keeping or promptly ordering important repair parts.

Will Determine What Roads Should Receive Federal Aid

Office of Public Roads Sends Questionnaire to All State Highway Departments—Only Vitally Necessary Work Encouraged

UNDER a recent date L. W. Page, director of the Office of Public Roads and Rural Engineering, sent to all district engineers the following letter:

In line with a request made by the Secretary of the Treasury, Hon. William G. McAdoo, to the Secretary of Agriculture, it has been determined that, so far as it is practicable to do so, the Federal Aid funds shall be applied during the working season of 1918 only to the construction of such roads as are vitally necessary to improve the transportation system of the country, or to make feasible an increased output of important agricultural products.

You will, therefore, take up with the several state highway departments in your district the question of formulating a program for the expenditure of all such funds as are available for the working season of 1918 and such additional period as may be required. All projects whether approved or pending, and any additional projects desired by the state should be included. The state highway departments should be requested to conform as nearly as possible to the foregoing policy.

A supply of schedule forms indicating the information desired is sent you herewith for use by the highway departments in preparing their program. It is important that this information should be had *at the earliest possible moment* and you will render all possible assistance to the state highway departments in their preparation of the schedule.

A map or maps should be submitted bearing coördinating references to the statements made by the state highway officials in the schedule.

Accompanying this letter was a large form containing questions to be answered by the state highway departments. The information thus secured will be of immediate value. The questions are:

1. Location of road by county and termini
2. Local name of road
3. Length in miles to be improved
4. Present type of surface
5. Present condition
6. Proposed type of surface
7. Approximate total cost
8. Approximate amount of Federal aid desired
9. Materials to be hauled in by rail

   Kind of Material
   Approx. Miles Rail Haul
   Sources (Producing Territory)
   Approx. Tons Required
   Approx. Period of Delivery

10. Relation of proposed road to other important roads in affording needed transportation facilities
11. Volume and character of present traffic
12. Probable change and increase in traffic to follow construction
13. The definite purposes to be served by the proposed improvement
14. The possible bearing of the proposed improvement on the war situation
15. Probable effect of delay in construction to the 1919 working season or later
16. The relative numerical rank in order of importance of the proposed improvement
17. Further remarks by State Highway Department

Draglines Make Bridge Across Rio Grande

To place two 60-ton Bucyrus dragline excavators in position for beginning work on the west side of the Mesilla Valley of the Rio Grande U. S. Reclamation Service Project, it was necessary to cross the river. The bridges in the vicinity are too narrow and would sustain only 25% of the weight of these machines. It was necessary therefore, says the October *Reclamation Record*, to run them on their own caterpillar tractors from the railroad station across the river bed to the proposed ditch location. A runway down the bank was excavated to reach the river bottom. The first machine crossed the quicksand in 1½ days, utilizing platforms to distribute the weight and to prevent the sinking which would have occurred if they had not been used. The second machine crossed in half a day.

Although the Elephant Butte dam gates were closed, it was impossible to dry the river bed completely and some excavating and damming had to be done to turn the thread of the stream behind the machines.

J. L. Burkholder, who was transferred recently from the drainage work on the Boise Project to El Paso, supervised the arrangements for the crossing.

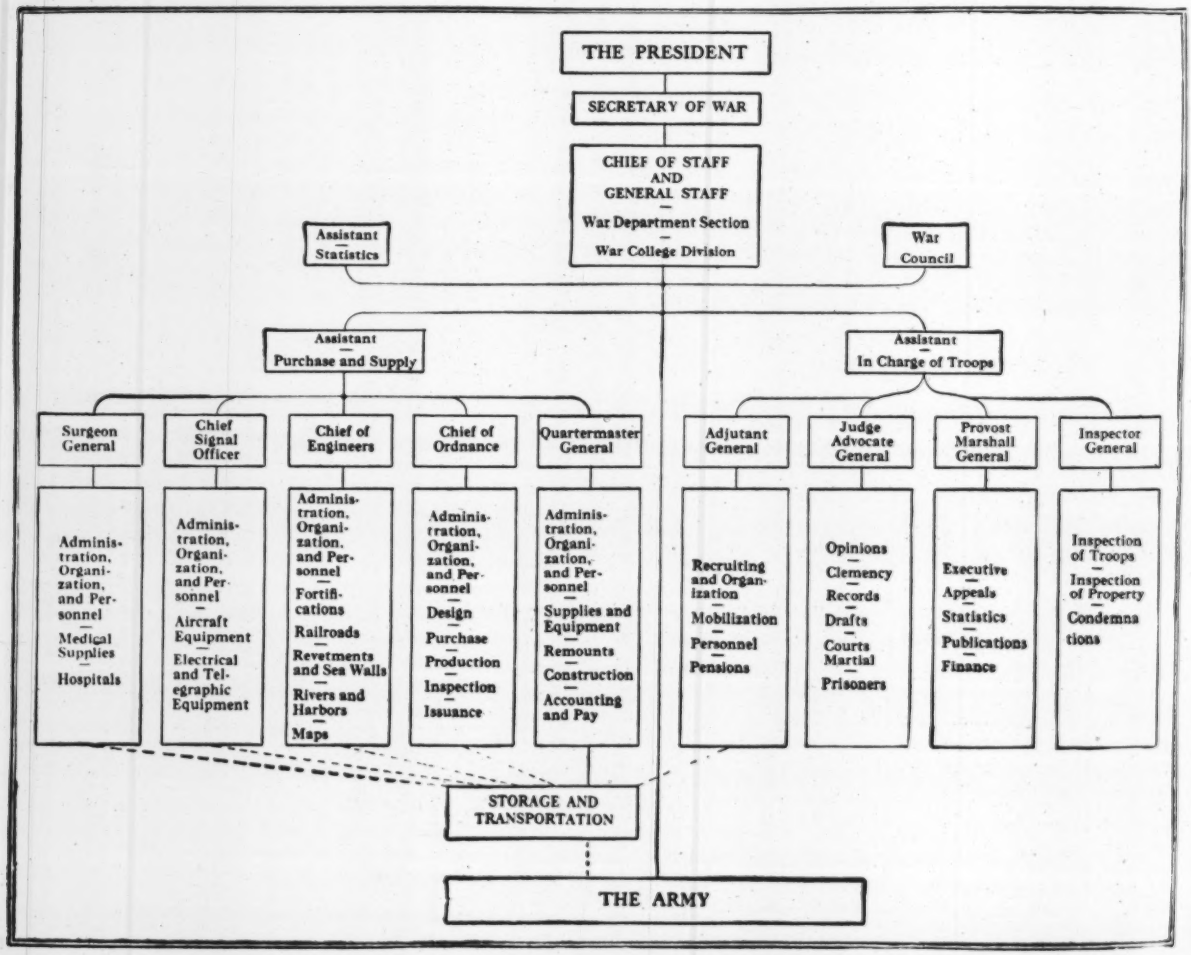
War Industries Board To Be Central Agency for Mobilizing Nation's Resources

Plan Outlined by Secretary Baker Coördinates Administration's Four Great Purchasing Branches, Utilizing Existing Machinery and Avoiding Disrupting Effect of Creation of Munitions Director

ON JAN. 12 Secretary Baker explained in considerable detail to the Senate Committee on Military Affairs the reasons for his personal objection at this time to the creation of a director of munitions to supervise all purchases of supplies of every sort for war purposes in this country. These reasons may be summarized briefly by the statement of opinion that the reorganization of the War Department and the War Industries Board will provide an entirely suitable agency for promptly and efficiently performing such work and should be tried before the present organization, now in process of remolding in the light of the experience of the administration in war work up to date, is thrown into inevitable confusion by drastic changes.

It was necessary at the beginning of American participation in the war to begin training immediately a great number of men to carry on the administrative and technical details of the department's work. No matter how these were ultimately grouped, they had to become familiar with their duties and with Government methods of work before they could render effective service. While this training was going on the reorganization of the department was being studied, and as army ordnance was in great demand this branch of the service was first changed.

It is a purely technical branch. Secretary Baker characterized it as a "manufacturing" branch, and the scheme of reorganization was developed with the help of men who have made a specialty of manufacturing organization. Formerly the work of the ordnance branch was subdivided according to products, such as small arms, but under the new system it is subdivided by functions, so that one branch will have charge of the technical details of design, another of purchase,


THE PRESIDENT
SECRETARY OF WAR
CHIEF OF STAFF AND GENERAL STAFF
War Department Section
War College Division
Assistant Statistics
War Council
Assistant Purchase and Supply
Assistant In Charge of Troops
Surgeon General
Chief Signal Officer
Chief of Engineers
Chief of Ordnance
Quartermaster General
Adjutant General
Judge Advocate General
Provost Marshall General
Inspector General
Administration, Organization, and Personnel — Medical Supplies — Hospitals
Administration, Organization, and Personnel — Aircraft Equipment — Electrical and Telegraphic Equipment
Administration, Organization, and Personnel — Fortifications — Railroads — Revetments and Sea Walls — Rivers and Harbors — Maps
Administration, Organization, and Personnel — Design — Purchase — Production — Inspection — Issuance
Administration, Organization, and Personnel — Supplies and Equipment — Remounts — Construction — Accounting and Pay
Recruiting and Organization — Mobilization — Personnel — Pensions
Opinions — Clemency — Records — Drafts — Courts Martial — Prisoners
Executive — Appeals — Statistics — Publications — Finance
Inspection of Troops — Inspection of Property — Condemnations
STORAGE AND TRANSPORTATION
THE ARMY

IN NEW ORGANIZATION OF WAR DEPARTMENT PURCHASE AND SUPPLY SECTION COÖRDINATES NEEDS OF FIVE MAIN BRANCHES OF DEPARTMENT

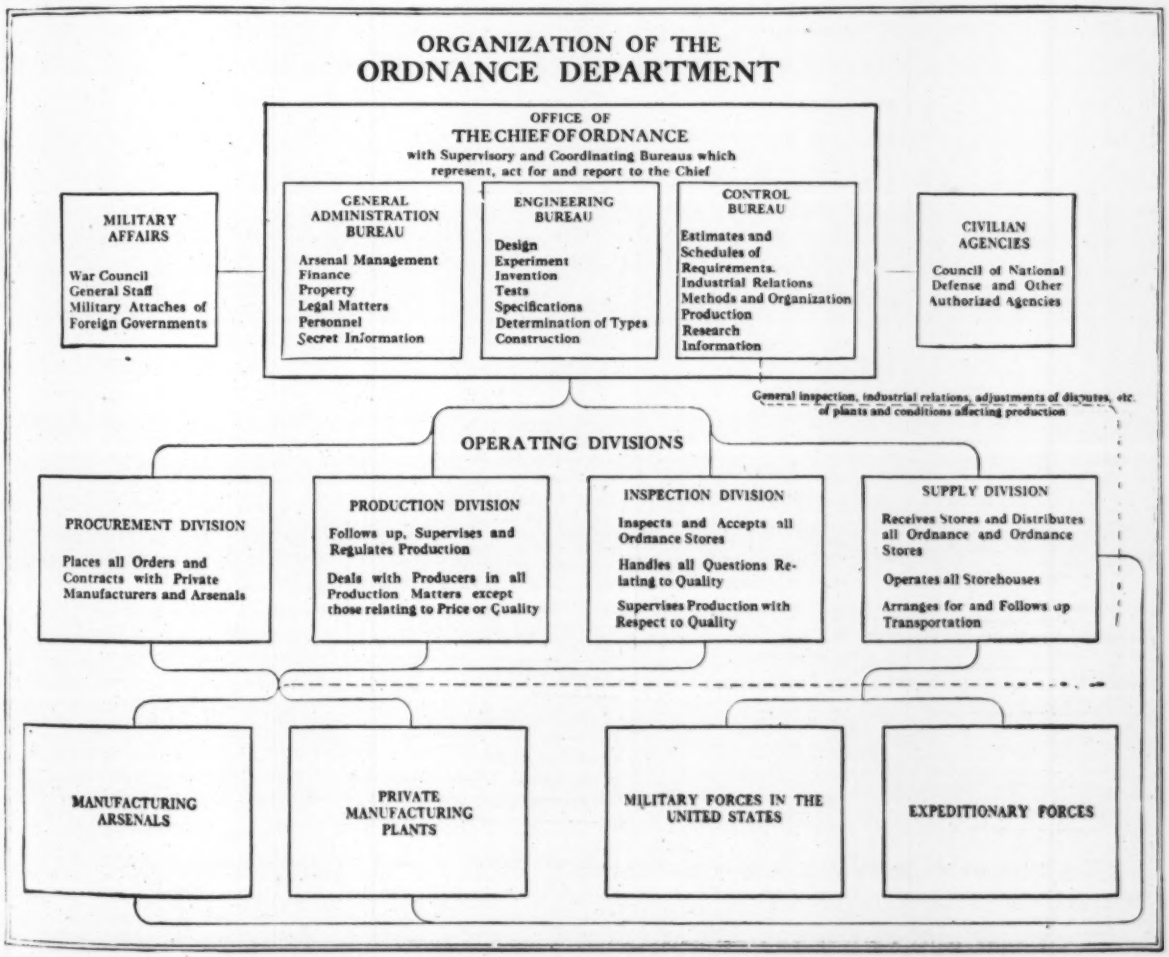
another of inspection and another of supplying the equipment when and where needed. This functionalizing of the ordnance branch is in harmony with the methods of organization now favored by a large number of the leading manufacturing corporations in the country. The men working under the old system of organization are having little difficulty in shifting into the new systems without interruption to their labors.

The quartermaster corps is now being reorganized in the same manner, and the high positions in it are being filled, as in the case of the ordnance branch, by civilians holding leading positions in the callings they have to carry on for the army.

Under the old scheme of organization there was an immense amount of detail which went from each branch of the department to the secretary's office. Under the new organization a very large part of this detail, which had to do with correlating the requirements for supplies for the different branches, goes directly to a central office. The ordnance, quartermaster, engineering, medical and aviation branches will purchase their supplies, as they have in the past, except that before contracts are signed they must have the approval of this central office, in order that one branch may not needlessly hinder the operations of another in the market, and other business reasons that need not be detailed here.

The War Department is not alone in making great drafts on the industries of the country. The Allies Purchasing Board, the Navy Department and the Shipping Board are similarly straining the resources of our manufacturers, and no legal remedy for this condition has been provided by Congress. But the four great purchasing agencies have agreed to joint action through the War Industries Board, which has been reorganized in order that it might do for all American munition manufacturers what the central bureau of the War Department does for its five great purchasing branches. The requirements of the four agencies are reported to a central committee, which is directly in touch with the manufacturing facilities of the country and knows not only how much work each factory is doing for the Government, but also how much it is doing for necessary civilian customers. It is this committee which passes on the priority to be given each of the orders. If its decisions are questioned, the appeal is made to the War Industries Board, which thus becomes arbiter of manufacturing priority in this country in every industry furnishing supplies for military purposes.

The committee has a further very important function which was explained by Secretary Baker as follows: Assume that General Pershing cables a requirement for 1000 guns. As his requisitions are not questioned, a



ORDNANCE DEPARTMENT NOW SUBDIVIDED BY FUNCTIONS, IN ACCORDANCE WITH GENERAL MANUFACTURING PRACTICE—QUARTERMASTER CORPS BEING SIMILARLY ORGANIZED

copy of the order would be sent at once to the ordnance branch of the War Department and another to the central committee of the War Industries Board. While the ordnance officials were preparing the plans and specifications the committee would ascertain what sources of raw materials could be used with the least interference to the manufacture of other necessary supplies, what forge shops could be utilized and what plants were available for producing the other parts of this order. As soon as word was received that the ordnance department was ready to buy these guns, the committee would notify the procurement division of the ordnance corps what parties should be invited to bid.

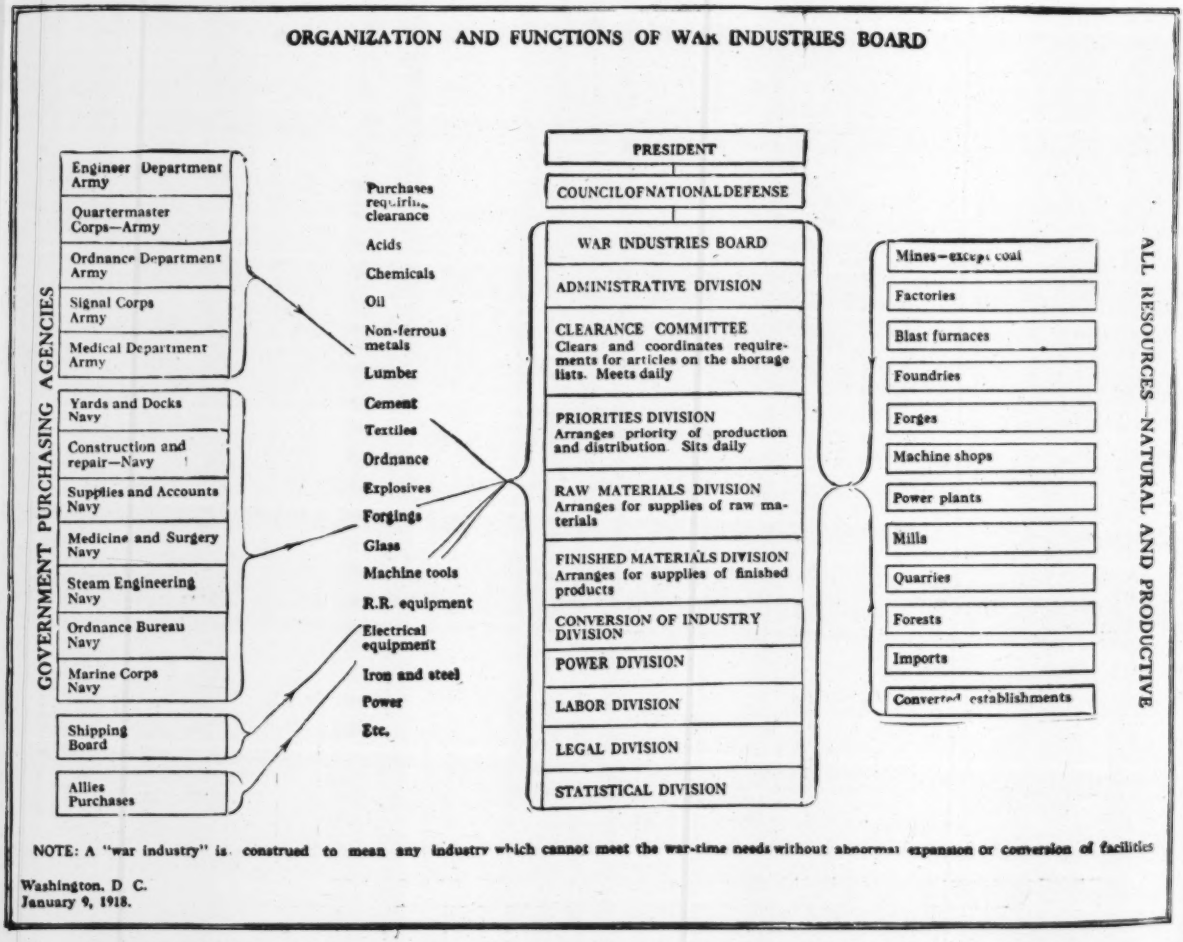
Secretary Baker assured the Senate Committee on Military Affairs that this system of handling the Government war purchases in coöperation with those of the Allies was the best that careful study had been able to suggest, and had met with the approval of the industrial leaders to whom it had been submitted. In his opinion it disorganized none of the existing machinery and interfered as little as possible with meeting civilian demands. It was the equivalent, he believed, of a special director of munitions, for any functions which such a director would have would be possessed by the chairman and executive officer of the War Industries Board. The chairman did not have legal authority to enforce his decisions, but as each of the four great war purchasing agencies had agreed to recognize his decisions as binding, it had not seemed necessary to ask congressional action to confer legal powers upon him.

The essence of the organization, according to Secretary Baker, is that each of the four great purchasers, the Allies' committee, the War and Navy Departments and the Shipping Board, has its own organization for acquiring its supplies in the decided order, while the War Industries Board has these orders filled in such a sequence that war needs, manufacturing and civilian requirements are served in the best possible manner.

This is apparently the administration's answer to the criticism that Washington had no logical plan for mobilizing the nation's resources. According to Secretary Baker, it is the best plan for the purpose that has been advanced in this country or Great Britain.

To Simplify Road Widening

Quite a mileage of 9-ft. brick roads is being built in Florida at present. It is the expectation to widen them when the traffic justifies. Therefore, the concrete curb on the side that will later be in the middle of the road is being poured in 6-ft. lengths, so as to be readily movable. The curb on the permanent edge is placed in 20-ft. lengths.



WAR INDUSTRIES BOARD NOW THE CENTRAL AGENCY FOR ARMY, NAVY, SHIPPING BOARD AND ALLIES' PURCHASES

Market and Warehouses Form Large Building Group

Produce Terminal for Los Angeles Comprises Seven Concrete Buildings Arranged Around Central Court

By L. A. Waterbury
Professor of Civil and Architectural Engineering, University of Arizona, Tucson

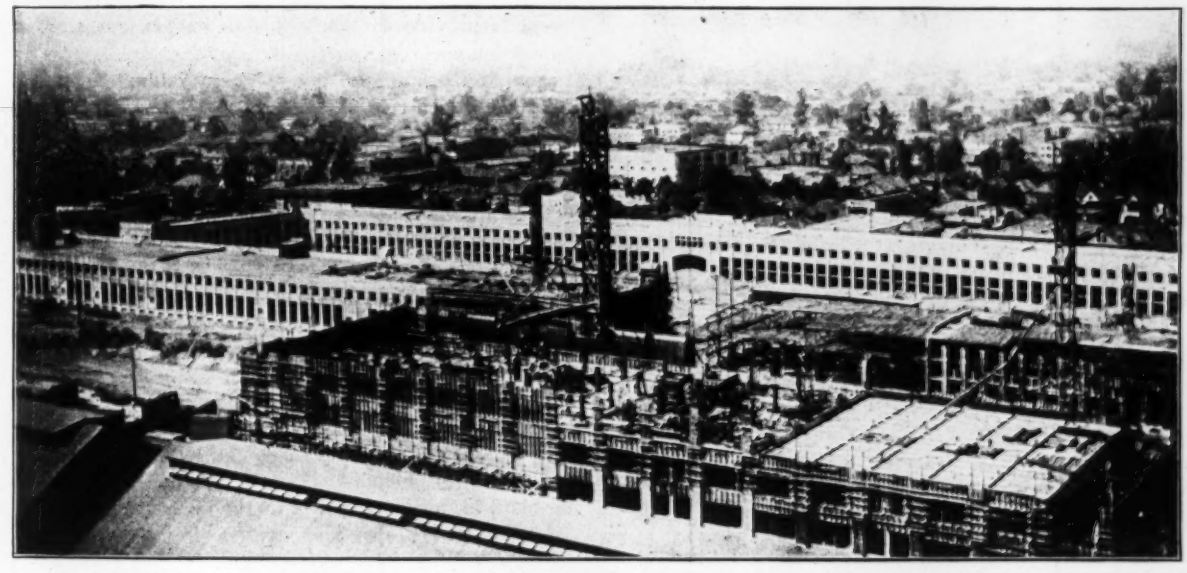
WHOLESALE produce warehouses, a market and offices are combined in a $3,000,000 group of seven reinforced-concrete buildings which the Los Angeles Union Terminal Co. has under construction. The structures will cover an area of 10 acres and have a combined floor space of 50 acres. The general arrangement is shown by the accompanying plan and perspective and the view indicates the construction as it appeared Oct. 11.

Building A will have its first floor used for retail markets and shops, with a branch bank at the corner of Seventh St. and Central Ave. The second floor is designed to include a produce exchange, offices, restaurants and a Japanese rooming house. Two portals through the first story of building A give direct access from Central Ave. to the market yard. For use as a market this area will be subdivided into a number of small areas, to be leased to produce dealers and others. Buildings B1 and B2, both of which are two-story structures, will be used principally as wholesale markets and warehouse, although some of the space in one building will be leased for a box factory.

Beyond these buildings are to be two six-story buildings, C1 and C2, but the construction of the latter may be deferred. Beyond the C-buildings are to be two more six-story buildings, designated as D1 and D2. The construction of the former is well under way, but work on D2 may be postponed for the present. Both the C-buildings and D-buildings will be utilized as wholesale produce warehouses and for light manufacturing, including such industries as a bakery, candy manufacturing, and a refrigerating and cold-storage plant.

The space separating the B-buildings from the C-buildings will accommodate railway tracks serving both sets of buildings, and it will also be used as a service street. The space between the C-buildings and the D-buildings will be used exclusively as a street, the latter buildings being served by tracks on the opposite side, which is adjacent to the Pacific Electric Railway.

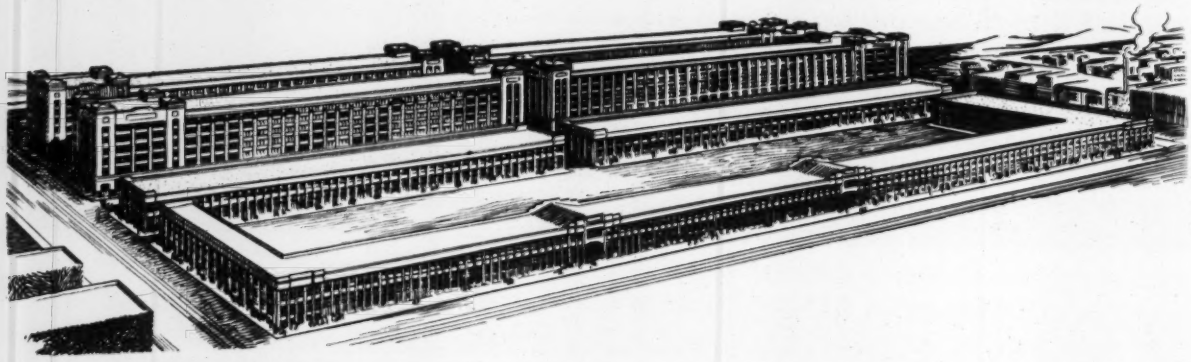
Building A is 40 ft. wide, two stories in height, with no basement. The exterior walls are of reinforced concrete, without other finish. The interior framing is of wood. The typical panel length for the exterior walls is 20 ft. Transverse fire walls of brick subdivide the building into floor areas not exceeding 7500 sq.ft. The first-story floor is formed of 3½ in. of concrete and 1½ in. of an asphaltic mixture. The second floor is finished in part with maple and in part with Oregon pine. The length of the building, including wings, is over 1500 ft. The ground area covered is 61,600 sq.ft., and the floor area is twice that amount. The live load used for the design of restaurants and produce exchange was 125 lb. per sq.ft. of floor, while for offices and rooming house a 75-lb. load was employed.



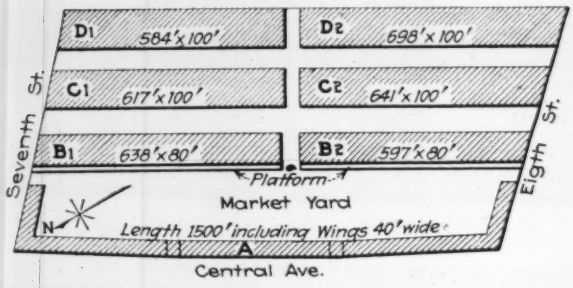
PRODUCE MARKET AND WAREHOUSE PLANT UNDER CONSTRUCTION IN LOS ANGELES. MARKET BUILDING IN THE REAR OF TWO-STORY WAREHOUSES. SIX-STORY WAREHOUSE IN FOREGROUND

Buildings B1 and B2 are similar in construction to building A, but each has a basement extending not only under the building proper but also under the concrete platform which adjoins the market yard. Each of these buildings is divided by brick fire walls into floor areas not exceeding 17,500 sq.ft. Each of these buildings was designed for a live load of 150 lb. per sq.ft. of floor. The floor finish is cement for the basement, maple for the first story, and Oregon pine for the second story.

Buildings C1 and D1 are of reinforced concrete throughout and the plans call for similar construction for the future buildings C2 and D2. Each of these is to be six stories in height, with a basement. The construction is of the beam-and-girder type, with the exception of that portion of D1 which is devoted to



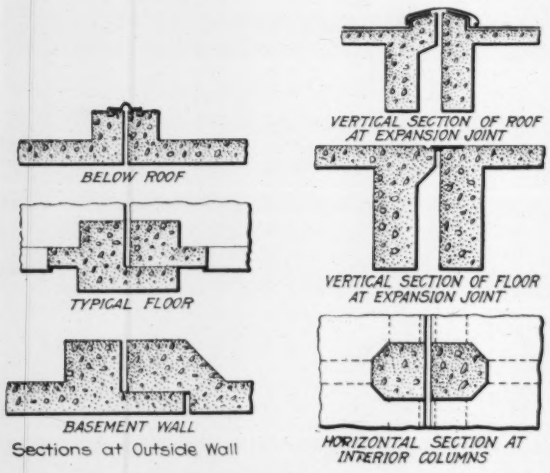
HOW MARKET AND WAREHOUSES WILL LOOK WHEN COMPLETED



PLAN OF BUILDINGS SHOWN IN ABOVE PERSPECTIVE

cold storage space. This section has floor slabs formed of hollow clay tile and reinforced-concrete joists, which in turn are supported by reinforced-concrete girders.

The typical slab for the cold storage floors consists of 14½ in. of tile and concrete, covered with 3 to 5 in. of


BELOW ROOF
TYPICAL FLOOR
BASEMENT WALL
Sections at Outside Wall
VERTICAL SECTION OF ROOF AT EXPANSION JOINT
VERTICAL SECTION OF FLOOR AT EXPANSION JOINT
HORIZONTAL SECTION AT INTERIOR COLUMNS

EXPANSION JOINTS IN REINFORCED-CONCRETE BUILDINGS

cork, which in turn is covered with 4 in. of concrete. The bottom of the slab also has from 3 to 5 in. of cork insulation and ¾ in. of cement plaster. In constructing these floors, the cork for the lower heat insulation was first placed upon the forms, a ½-in. layer of cement grout was placed upon the cork, and the tiles were bedded in this grout. The reinforcement was then placed and the floors were cast to the level of the top of the rough concrete.

The typical size of floor panels, for the reinforced-concrete buildings, is 18 ft. 9 in. by 19 ft. 9 in. between centers of columns. The live load used for the design was 300 lb. per sq.ft. of floor, except that in C1 a load of 400 lb. was used for the first floor, and special loadings were used on the fifth and sixth floors, to provide for loads due to bakery ovens. For typical columns, the bearing area of footings is 14 x 14 ft., and the largest footing of an individual column is 18 ft. square. All of the foundations rest upon sand.

Expansion joints extending through the cross-section of the buildings are provided at intervals of approximately 200 ft. At the outside walls the joint is arranged to be as inconspicuous as possible, the general arrangement being shown by the sections in the detail drawing. The distance allowed for expansion is 2 in. Other sections show expansion joints at the interior columns and in the floor and roof. A steel plate is used to cover the crack in the floor.

Elevators are to be installed in all of the buildings except building A. Electric lighting is provided for all buildings. Heating is included in the contract for building A, but for the other buildings the heating mains only are included. The boiler room for the heating plant is in the south end of the basement of C1.

An automatic sprinkler system is being installed, which will cover all of the buildings except building A. It includes two underground reservoirs with a capacity of 75,000 gal. each, and two elevated steel gravity tanks each having a capacity of 40,000, gal. The bottom of each tank is to be at an elevation of 37 ft. above the roofs of the six-story buildings. The reservoirs are to be constructed under the pavement of the market yard, and between them is to be a pump pit equipped with two automatic fire pumps, each having a capacity of 750 gal. per minute.

The architect for the building in John Parkinson, of Los Angeles, for whom A. L. Bush is chief engineer. The contractor is the Wurster Construction Co., of San Diego and Los Angeles.

Sale of National Forest Timber

More than two billion feet, board measure, of national forest timber was sold in the fiscal year 1917, valued at more than $3,715,000, according to the annual report of the U. S. Forest Service, recently issued. During this period approximately 727,000,000 ft. was cut and removed, for which the purchasers paid $1,507,303.

Turning Back Abutment Wing Walls Saves Material

Revising Layout of Straight Wall Abutments Also Improves Appearance, Particularly in Skew Bridge

By Charles K. Mohler
Consulting Engineer, Los Angeles, Calif.

THE design of short span bridge abutments has not generally received the degree of care and attention that its importance demands. Among the more important features of neglect are those of appearance and cost.

Turning back the wing walls of abutments from the straight line of the abutment face is a common but by no means universal practice. Many abutments of the straight type continue to be built, although in square bridges it results in the use of more material than necessary and in skew bridges it not only wastes material but with improper design leaves an unsightly wall protruding in the obtuse angle of the skew. The saving in material, both masonry and fill, by turning back the walls may be indicated by reference to some typical revisions of straight-wall designs. In these revisions the simple details of the wing-wall layout are given.

In Fig. 1 are shown, on the left, an existing straight wall abutment and, on the right, a suggested improvement in which the obtuse angle of the skew is turned back. The wings of the wall as built were carried out parallel to the face of the abutment to meet the theoretical toe of the slope. On the full (acute-angle) end of the abutment the fill actually tailed out that far. On the slack (obtuse-angle) end, however, the fill, being carried at grade only to the face wall, tailed down the wing far below its top, about as shown in the view of another, but similar, bridge in Fig. 2.

In order to save this excess masonry in the redesign the obtuse wing is turned back as shown, leaving the bridge pedestals in precisely the same location as before, but allowing the fill to tail around the wing, though not to protrude onto the undercrossing.

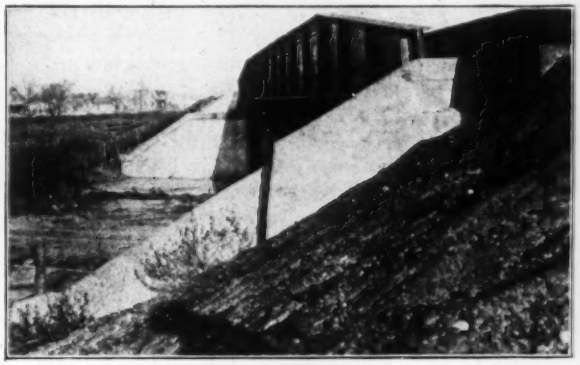


FIG. 2. IN THIS ABUTMENT SLOPE DOES NOT COVER WING WALLS

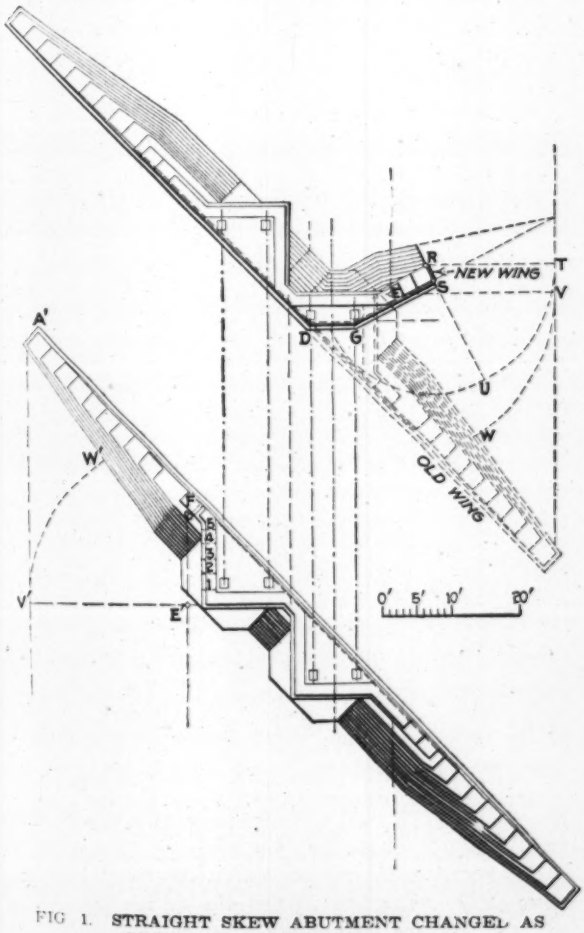


FIG. 1. STRAIGHT SKEW ABUTMENT CHANGED AS SHOWN IN UPPER RIGHT WING

The detailed layout is made on the following basis: At D, where the neat line of coping intersects the line of the inside girder, the face of the abutment is turned at right angles to the bridge. At G, the center line of the outside girder, the abutment face is again turned to give the wing angle of 26° 34′. This angle is used so that the tangent comes even inches for even feet. As most bridge abutments are laid out and built by either stone masons or carpenters, who use the carpenter's rule, it is of some importance, or at least convenience, to use angles giving even inches for their tangents, with the foot as the unit of measure.

A wing wall turned back toward the bank not over about 30° is not materially increased in length, even when run out to the bottom of the slope. The main advantage in turning the wing back is to allow room for the embankment to flow around the end and in front of the wall, when the length of the wing is reduced. The revision gives about 35 ft. less length of wing wall than the original plan.

To show that the embankment slope has been properly taken care of in the revision, take R, the intersection of the slope and the back of wall, as a center and with radius RT strike the arc TU. From the point U the radius changes from RU to SU (being reduced by the thickness of the wall), and S becomes the center of the arc or slope flow. Continuing the arc around to the face of the revision wall, it will be seen that the toe of slope, as represented by the arc, falls about a foot short of reaching the face of the original-plan wall.

The advantages of the revised plan are as follows:

1. The saving of about 100 cu.yd. of masonry by re-

ducing the length and in part the thickness of the wing wall.

2. A less amount of fill.

3. Turning the wing back allows the back-wall to be carried straight out to the returned face of the abutment and the reduction of the wall thickness to the theoretical requirements. Where the wing is not turned back the extra bridge-seat thickness has to be carried out to the end of the wing or the backwall turned and brought forward to the face of the abutment.

4. With the wings of both abutments turned back as shown in the revision a much more open and pleasing appearance is given to the roadway from beneath.

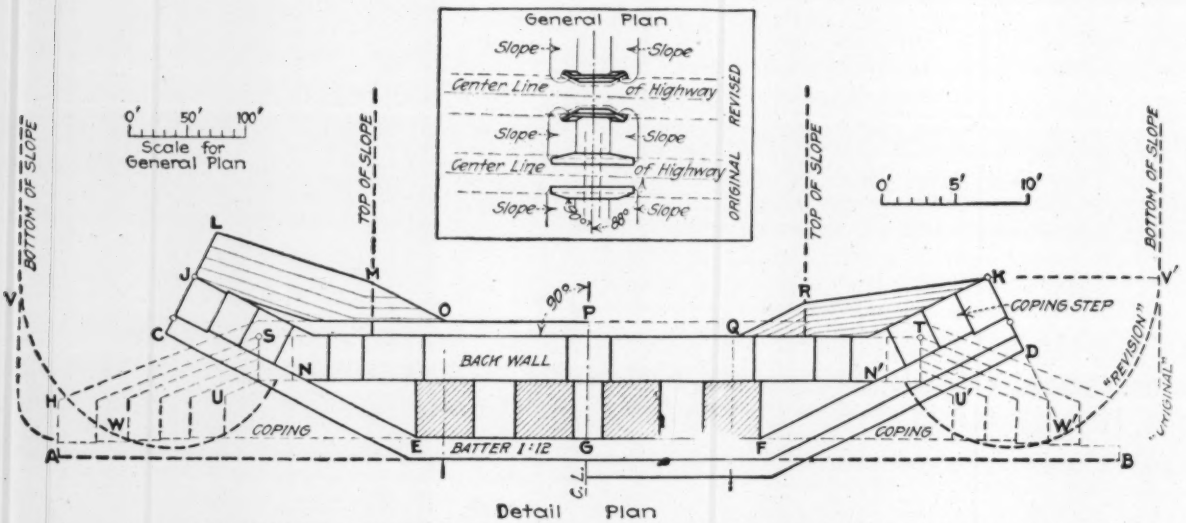


FIG. 3. SQUARE ABUTMENT CAN BE REVISED BY TURNING BACK WING WALLS

5. The displeasing protruding walls are done away with.

The total net saving in cost for the revised plan as against the original would amount roughly to from $1500 to $2000, depending on the character of the masonry. The total cost of both abutments on the original plan would be from $6000 to $8000 and the deck plate girders about $3200. Strictly equalizing the cost of the substructure and superstructure would still further reduce abutment cost from $1000 to $2000. The higher rate of depreciation for steel spans leaves a somewhat greater cost for the substructure generally allowable and advisable.

Another revision possible is to turn the whole wing back at an angle of 90° to the bridge axis. No sketch is given for this, as the wing would be of normal length and slope. The wing may ordinarily be reduced in length to allow the fill to flow around the end in front to meet about the line of the lower roadway.

If it is desirable or necessary to make the wings of a skew abutment straight, the wing projecting away from the embankment should be shortened enough to meet the slope. A full revision sketch to meet this requirement will not be given. Enough can be described from the left abutment in Fig. 1 to illustrate the principles.

There is no requirement to maintain the full width and height of the embankment beyond the point E′. With the original wall designed as shown, having the back-wall and coping parallel to the girder along the line 1, 2, 3, 4, 5, the slope will fall away from E′ toward F′, a distance of about 13.5 ft., losing about 9 ft. in elevation. The back-wall and wing should accordingly slope down along steps 1, 2, 3, etc., shown in dotted lines. Step 4 corresponds with the top of the coping course. The point F′ is well below the coping elevation. If the coping is carried out full height to the face of the abutment, then steps 4 and 5 would be omitted and their combined height set off at the face angle between 5 and 6. Step 6 would then be the next step actually to intersect the slope at the theoretical point. Beyond 6 the steps should be on a slope of 1½ to 1, rather than the flatter ratio determined by multiplying the regular slope lengths by the cosecant of the angle the bridge makes with the face of the abutment, as used in the original plan.

The end of the wall will be at W′ instead of at A′ and the length of wall saved is represented by W′A′.

In square bridges certain revisions of the wing walls can also be economically made. Fig. 3 shows in dotted lines the layout of a square bridge abutment in which the wing walls are prolongations of the face wall. Revisions of similar type but different detail are shown at each end in solid lines, and in small scale are shown the new and old layouts in comparable form.

In the original plan the wall offsets have left the wings too long. The bank slope meets the outer end of the steps at the bottom, and all steps are on a uniform pitch. The rear of the back-wall steps T and S are about 4 ft. back of the rear of the steps U and U′. The bank slope at 1½ to 1 will drop two feet in the three feet width of the back wall and consequently fall below the bottom of the coping course, which is 1 ft. 4 in. thick. There is therefore no need for a coping step. The drop of slope in the 4 ft. forward offset from back wall is 2 ft. 8 in., equal to the combined thickness of the coping and the course below. It will thus be seen that two steps can be omitted and the wall still meet the theoretical slope. Each wing of the abutment is from 4 to 5 ft. longer than necessary and will stand from 2 to 3 ft. above the bank slope.

Furthermore, in the old design the roadway is unnecessarily obstructed. When the center line of the roadway and the face of the abutment are not exactly

parallel, as in this case, there is much less encroacnment on the roadway with the wings turned back. Compare the "revised" and "original" of the general plan.

The wings can be turned back to reduce length and save masonry and to procure a more open roadway. By turning the wings back they can be shortened and the slope allowed to run around in front of the abutment. This, together with the reduction in length above detailed, gives a total of nearly 7 ft., amounting for each wing to about 14 cu.yd. or 56 in all. The saving in cost is about $450. The "confined" minimum width of roadway between abutments is reduced from a length of about 74 ft. to 26 ft. by turning the wings back. This gives a much more open and inviting appearance.

A particular defect of the original design is that there is no reduction in the thickness of the wall until the end of the back-wall steps at T and S are reached. Thickness reduction should begin at R and M, the edge of top of bank, instead of at the accidental or arbitrary end of back-wall steps T and S. The revision gives a 30 ft. length (MR) of full thickness wall instead of 46 ft. (ST) in the original. In addition the excess thickness of the wall at and below the bridge-seat coping is reduced as soon as the angle is turned at F and E, and has been entirely eliminated before the points T and S of the original design are reached. The length of the excess thickness from R to T and from M to S is about 8 ft. for each. The length of the wedge-shaped excess thickness EN and FN of the revision is also about 8 ft. each, or an equivalent average of 8 ft. for both wings.

The revision shown on the right is more consistent and complete than that on the left. The latter is largely a copy of the original lines of layout.

The total saving by the revisions shown for two abutments would probably amount to $800. The cost of the two deck girder spans would be about $1500 or less than double the amount that could be saved on the abutments by very simple revisions. The revisions shown are by no means all that could reasonably be made.

The approximate amount of masonry in two abutments is 780 cu.yd. The cost for original design at $8 per cu.yd. amounts to $6240. The total for span and abutments is roughly $7740 and the cost of spans is only a little over 19% of the total cost. With the saving on the abutments by the revisions shown, the deck plate girders still represent only a little over 21% of the total cost. This leaves room for still further cutting down the cost by increasing the span and reducing the length of the abutment wings.

Change in Manchester Department of Public Works Advised

City Manager and Research Bureau Engineer Survey Organization and Work of Department of Granite State City

A NUMBER of suggestions of more than local interest were made in what the authors termed a "build-as-you-go survey" of the Department of Public Works of Manchester, N. H., not long ago. The report was addressed to the Manchester Board of Commerce by the Institute for Public Service, New York City, and was made by Gaylord C. Cummin, city manager, Grand Rapids, Mich., and H. S. Morse, engineer, Detroit Bureau of Governmental Research. The portions of the report of most interest to the readers of *Engineering News-Record* deal with proposed changes in the organization of the Department of Public Works.

The department consists of a commission of three members appointed by the mayor. The commission in turn appoints a director of public works, and he appoints heads of six divisions, which, with their duties are: (1) equipment and supplies, having charge of bookkeeping, purchasing, filing, payrolls, etc.; (2) highways, in charge of new construction on streets, sidewalks, bridges and culverts, and maintenance of the same, together with the watering and oiling of streets; (3) sewers, having charge of construction, maintenance and repair of the sewerage system, with the exception of the cleaning of catchbasins; (4) street cleaning, in charge of everything the name implies, including the cleaning of catchbasins, the collection and disposal of ashes and rubbish, and the collection of such garbage as is not collected by private parties; (5) transportation, equipment and supplies; (6) engineering, in charge of all surveys, plans, etc., lines and grades for public improvements, together with the giving of sidewalk grades for private building construction; also in charge of various records and costs, permits for sewer connections, and all engineering work for parks, playgrounds and cemeteries.

Do Away with Commission of Public Works

The authors of the report start in boldly by recommending that the legislature be requested to abolish the Commission of Public Works, which was created by a legislative act early in 1917. The commissioners themselves feel that even under favorable circumstances their value is principally advisory. The report states that such advisory help as the commissioners can give could doubtless be obtained from a non-official body. Since the commission, in less favorable political conditions than now prevail, may in the future give rise to trouble, the report suggests that the commision be abolished and the director of public works be made responsible solely to the mayor.

The report advises that the supervision and operation of the municipal asphalt plant, gravel pit, and concrete mixer (when the latter is in the yard) be transferred from the division of highways to the division of transportation, equipment and supplies. It is thought that this would give rise to better accounting control. Another proposed transfer would place the sprinkling and oiling of streets in the division of street cleaning, instead of in the division of highways. The work might go in either department with equal logic, the report says, but in order to secure a more even distribution of work among divisions, as well as to give greatest stability to divisional organizations, the transfer is advised.

Before the reorganization of the Department of Public Works under the legislation passed early in 1917, the present director of public works served as city engineer. Apparently there has been no city engineer since the

reorganization. The report states that the director cannot properly fulfill the duties of that office and the detailed work of the division of engineering. It is, therefore, recommended that an engineer be placed in charge of the division of engineering under the director of public works. It is stated that "the chief function of the proposed engineer-in charge should be the design of all improvements."

The plan is to have the division of transportation, equipment and supplies "self-supporting by charging for all materials, supplies, equipment, or transportation service rendered to the other divisions." This would simplify cost keeping "and is admirable as a means of control of all materials, supplies, and equipment used by the city."

The report suggests that the same principle might be extended to the divisions of adminstration and of engineering, thus having three self-supporting divisions for which no appropriations should be made in the city budget. At present the division of engineering renders service to the department of parks, commons and playgrounds, and to the trustees of the cemeteries, without charge. Commenting on this, the report says: "While from the taxpayer's viewpoint the ultimate results are the same, for correct accounting a proper charge should be made for such service. Under such a system the division of engineering will be in position to render service on call to these or any other city departments, and will have no reason of self-protection for not doing so, since the cost will be borne by those activities which get the service."

Manchester now has only 13 miles of so-called permanently paved streets. It is estimated in the report that there should be at least 35 miles of such pavements. In support of this, it is stated that in 1916 the cost of street maintenance, not including sprinkling and oiling, was $106,000, while only $90,000 was spent for permanent pavements. The only way to reduce the heavy maintenance cost is to outline and carry out as rapidly as possible a paving program extending over a period of years.

It is recommended that in the next budget provision be made for an additional field party in the division of engineering for the purpose of "revising and extending to the city limits the topographic map of the city and revising and extending the system of bench levels." The present topographic map was made in 1888 and the bench levels were installed in 1901. An up-to-date topographic map "is of the utmost value in planning intelligently for the future development and improvement of the city, and the bench levels are essential to the making of the map and to the accurate construction of the improvements."

A start toward a centralized purchasing department for the city is advised. At the beginning, at least, it is said that this function might readily be assumed by either the mayor or the office of the Department of Public Works. There is reason for choosing the latter since it "is the largest single purchaser of city supplies and has the organization most readily adapted to purchasing work."

Water Tears Quarter-Inch Tunnel Lining to Pieces

Head of 56 Feet in Santa Maria Lake Dam Rips Steel Without Much Bending or Twisting—Concrete Not Eroded

WATER issuing under a 56-ft. head from two 48-in. pipes into the outlet tunnel of the Santa Maria Lake dam, Colorado, tore a lining of ¼-in. steel into many small pieces as one might tear a sheet of paper. Although this occurred in 1914, the information has only recently been made available through a description given by T. W. Jaycox, consulting engineer, in a discussion before the Colorado Association of Members of the American Society of Civil Engineers.

The outlet control of this hydraulic filled dam, described in *Engineering News* of Oct. 10, 1912, p. 669, and *Engineering Record* of Oct. 12, 1912, p. 396, consists of two 48-in. pipes and one 36-in. pipe with gate valves 5 ft. back from the issuing end. The valves are set in an enlarged portion of the tunnel which has a flat invert, straight sides for 4 to 6 ft. high on the sides, and an arched top. The width tapers from 14 ft. at the end of the pipes to 6 ft. at the regular section of the tunnel, 14 ft. away. The smaller pipe is set in the center and the 48-in. pipe centers are 2 ft. from the side walls.

STEEL OUTLET LINING TORN INTO TWENTY-FIVE PIECES—TEARS DO NOT INDICATE MUCH TWISTING OR BENDING

A pan of ¼-in. steel weighing 4000 lb. was set in this tapered section to line the invert and 4 ft. up the sides. It was bonded to the concrete lining and also anchored by a Z-bar riveted horizontally along the back of the top

edge of each steel plate, which was imbedded in the concrete.

It was thought that the energy of the water would be destroyed by having it swirl in a comparatively small chamber, expending its force against the walls of the chamber and itself, but what the effect would be on the walls was questionable, and to afford greater protection the steel pan, covering the floor and lower part of the side walls, was adopted.

On account of rains in the San Luis Valley there was no demand for storage water in 1914, and the reservoir was at the 56-ft. stage on Sept. 17, when it was ordered to be emptied. The rapidity of the discharge was placed at 450 to 500 cu.ft. per second, to test the outlet works and to observe the conditions when this large quantity of water was running, and also to comply with the request of the state engineer that this run of water be completed before he began seepage measurements on the Rio Grande. Accordingly, 21,000 acre-feet were run out in 30 days and at the rate of 450 sec.ft. for two weeks. Because of the difficulty in turning the stem of the small valve, only the two 48-in. valves were opened. The streams from these valves, having a probable theoretical velocity of 50 to 60 ft. per second and a volume of 200 sec.-ft. or more, discharged directly against the inclined surface of the side plates. In some manner the destruction of the entire steel pan was effected.

An examination disclosed the pan torn away from the concrete and jammed into the small end of the taper. Pieces as small as 16 sq.in. in area, and none exceeding 3 ft. square, were found on the tunnel floor. In all, 25 pieces were recovered. These were assembled and are marked with a cross in the accompanying photograph. Some of the smaller pieces inspected in Mr. Jaycox's office show clean, jagged, torn edges and an excellent grade of steel. The edges showed that they had been pulled asunder, but none was much bent or twisted. These pieces, in Mr. Jaycox's opinion, must have been stripped off while the plates were held firmly in place, as one side would have to be fast in order that the other side might be torn away, or else the whole plate would have moved and no stripping would have occurred. The Z-bar at the left of the picture is the entire length of one inclined side of the chamber, over 10 ft. long. It is not bent, is really as straight as when put in, and was torn from the body of the steel plate and not through the line of rivets joining the plate and the Z-bar.

It would appear probable that one side plate was first destroyed by the water making or finding an opening behind it, and, once having that place, the water soon accomplished the ripping and tearing. This afforded an opening for the water to get under the floor plate, raising and bulging it, so that the edge was pulled from under the discharge pipes. It was then quickly rolled, bent and pushed into the entrance of the tunnel section, where it was found. To remove the pan, it was cut in two pieces by the use of hack saws.

What is considered the remarkable thing about the occurrence was the behavior of the concrete lining under this punishment. Behind the pan, where it was impossible to manipulate a spade, the concrete was quite rough. No apparent damage had been done to it, and no erosion was noticeable. Portions could be broken off, as might be expected from such loosely knit concrete.

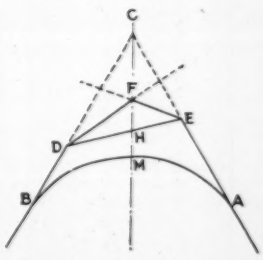
Arthur P. Davis, chief engineer, U. S. Reclamation Service, in *Engineering News* of Jan. 4, 1912, p. 20, gives an account of a similar experience with the lining of outlets of the Pathfinder dam when discharging at 150-ft. head. Nearly all of the steel lining was torn out of the tunnel, all of the concrete thus exposed was carried away and considerable erosive effect upon the granite was noted. He does not tell how the repairs were made. Mr. Jaycox's repairs consisted in the application of a cement mortar coating 1½ in. thick. This has successfully resisted the impact of the water discharged against it for the last three years. This year the head was 70 feet.

Externals Instead of Tangent Distances for Lining Railroad Curves

By C. E. Newell
Corydon, Ind.

ENGINEERS who have occasion to set track centers for railroad curves for which they have no notes may find the following suggestions useful where it is difficult or practically impossible to produce tangents to intersection:

Measure along the center of the existing curve and mark the stationing on the rail. Produce the established tangents to arbitrarily selected points E and D (see the sketch), visible from each other. Bisect the angles CED and CDE and produce the bisecting lines to an intersection at F. Obtain an intersection of the line bisecting the angle DFE with the line DE at H, and the plus to the intersection of the line FH produced with the center line of the existing curve at M. Measure the distances HE or HD and HM.



From these data the external CM of the existing curve can be obtained, as the angle ECH or DCH is one-half the intersection angle, and the angles CED and CDE have been measured. The degree of trial curve having been determined from the intersection angle and the external, the curve can be run in from points one-half the length of the curve either side of the point M. Unless considerable throw is required to bring track to new location it will be unnecessary to remeasure the curve.

In many instances it will prove more accurate and satisfactory to triangulate for the external distances from a right-angle line of a convenient length extending from any suitable point on the external than it will to measure this distance with a tape the distance would have to be measured accurately. In any event the use of externals will prove far superior to the use of tangent distances in doing work of this character.

Almost Completely Sewered

The sanitary sewer system of Palo Alto, Calif., is completed on 97% of the streets, and all houses on those streets are connected with the sewers, according to the annual city report for 1916-17. J. F. Byxbee, Jr., is city engineer.

Standpipe Demolished After Forty Years' Service

Wrought-Iron Structure at Toledo, 224 Feet High, and Inclosed in Brick Tower, Cut Into Sections by Oxyacetylene Torch

BY C. N. SCHOONMAKER
Constructing Engineer, Toledo Water-Works

THE recent tearing down of the 224-ft. standpipe and inclosing tower at Toledo, Ohio, was notable both as a contract job and because the structure was one of the highest standpipes in the country. Moreover, although it had been in use more than forty years it came to its end through obsolescence rather than decay.

The structure was designed by the late J. D. Cook, as a part of the water-works built by Toledo in 1873-4. The standpipe was 5 ft. in diameter, with plates successively ¾, ⅝ and ½ in. thick. It was inclosed by the ornamental brick tower shown by the accompanying view. Space for a stairway on one side and an elevator on the other side was provided between the standpipe and the tower, but the stairway alone was built.

Photographed by I. H. Pariskey
TOLEDO'S INCLOSED WATER-WORKS STANDPIPE SERVED MORE THAN FORTY YEARS

The standpipe and tower were torn down to make room for a new force-main header system, with central valves control—but not until it had been shown by trial that oth the pumps and distributing mains would not be badly affected by direct pumping.

The work of destruction, which extended to the ground line only, was done under a contract let in October, 1916, for $1850 and salvage. The highest of four other bids was $7200 and salvage. Earlier bids were rejected because of lack of competition and high prices. The salvage was reported by the contractor to be 750,000 brick, 37 tons of wrought-iron, and 2600 lb. of lead, the latter from the cornice. The estimated salvage, in advance of the letting, was 1,440,000 brick and 30 tons of wrought iron.

The methods employed by the contractor for the demolition of the standpipe and tower were substantially as follows: The upper half section of the tower was scaffolded. The recesses left in the wall when the stairway was removed were used for beam supports and as these were about 4 ft. apart no additional cutting out was necessary. Construction similar to that used in chimney falsework was carried up from the beam supports, to which a zigzag chute was attached for the removal of all débris, all being taken down as the work progressed toward the ground. A small hoisting engine was used for handling the heavier material.

All metal work was cut in 4-ft. sections and each cylindrical section was then halved so that handling became more easily managed. This work was performed with an oxyacetylene torch.

The work of demolishing the uppermost portion of the tower proceeded rapidly, as the brickwork was set up in lime mortar and was easily removed. The lower half required removal with sledges and picks, as these joints had been made with cement.

The contractors were Doan & Langenderfer, Toledo, who were under the supervision of the Division of Water, of which Thomas R. Cook is commissioner, W. G. Clark, consulting engineer, and the writer, construction engineer. David H. Goodwillis is director of public service.

St. Paul Committee Proposes Minimum Fees for Engineers

Sliding Scale for Definite Services Performed—Additional Charges for Time Beyond Contract Period

MINIMUM charges for professional services are given in a schedule proposed by a committee of the Civil Engineers' Society of St. Paul on engineering compensation. Before adoption discussion is desired as to whether the fees are proper, whether competition is such that it will be impossible to enforce such a schedule, and proper fees for cases not covered.

The engineer's profesional services are defined so as to consist of the necessary conferences, preliminary surveys, preliminary studies and reports, preparation of working drawings, specifications and such detailed drawings as may be necessary for furnishing proper information to the contractors for the preparation of bids for the construction of the work, and the general supervision of the construction work.

For the preparation of a preliminary report with a general plan and an estimate of cost upon any project the fee shall not be less than ¾% of the minimum estimated cost, and no fee for the above work shall be less than $150.

The engineer's charge for complete plans and specifications, including preliminary report and survey, but exclusive of soundings and borings, shall be made according to the following schedule:

For work estimated to cost less than $10,000, 3½% of the total estimated cost of the improvement exclusive of the land; less than $25,000, 3%; more than $50,000, 2½ per cent.

The charge for consulting superintendence shall be 2½% of the cost of the work. This consulting superintendence shall be taken to mean occasional visits to the work and each contract shall state specifically the number of trips which are contemplated. Additional trips shall be charged for at a rate per day with expenses added.

Where work is especially difficult or expensive it shall be proper to charge a fee in excess of the amount specified above in proportion to the increased cost of the work to the engineer.

If the work shall be let to several contractors or under a percentage contract or in any other manner which shall render the superintendence more difficult or expensive to the engineer, a special fee may be charged covering the additional expense to the engineer.

Each engineering proposal shall state specifically the length of time which is considered as proper for the contractor to complete the work. If for any reason the work shall be extended beyond this proper contract period a charge shall be made for such additional expense entailed upon the engineer.

Where the engineer is not otherwise retained, consistent fees for professional advice shall be paid in proportion to the importance of the question involved and the services rendered. The services of the engineer shall not be taken to include the expense of special foundation exploration, tests of concrete, reinforcing steel, or other materials, which service should be done under the general supervision of the engineer by specialists in that particular line of work and should be paid for by the owner directly to the persons making such tests, etc. In case continuous inspection is desired upon any work a resident engineer shall be furnished at a charge per month including his expenses. If, after the preliminary plans have been approved, changes in drawings, specifications or other documents are required by the municipality, or if the engineer shall be put to extra labor and expense by the delinquency or insolvency of the contractor, the engineer shall be paid for such additional services and expense.

The personnel of the committee is as follows: W. E. King, T. F. McMahon, A. F. Meyer and J. F. Druar.

Navy Could Change Site and Annul Contract but Could Not Collect

In a case involving a suit over the construction of a sawmill, boiler house and steel stack at the Mare Island Navy Yard in California, the Supreme Court of the United States recently held that, under the circumstances, the Navy Department had been within its rights in setting aside the first contract and reletting the work, but on the other hand, could not recover damages, since the change in location of the plant involved such extensive changes in the design of the structure that the second contractor, who actually carried out the work, built something different from what the first contractor bid on. Consequently the first contractor was not liable for the difference between the amount of his bid and the final cost of the work. The first contractor also recovered for materials delivered and used by the Government.

The case was a suit by the California Bridge & Construction Co. against the United States, based upon alleged breach of contract, to which the Government set up the defense that the contractor had defaulted in the performance of the contract and that the Government had secured its completion by a new contractor at a greatly increased expense. On this ground the Government set up a counter-claim for the excess in the cost of completion under the second contract above what the Government would have had to pay to secure the structure under the first contract.

The president of the California Bridge & Construction Co. visited the navy yard before bidding and saw the ground staked out for the proposed structure. He was informed, however, by authorized officers of the United States that the location had not been finally determined and was subject to change. After the contract was entered into the location was changed to another, where construction was more difficult and expensive, particularly in requiring longer foundation piles.

The Supreme Court held, in view of the information given to the contractor before bidding, that the site was not finally selected, but was liable to change, and inasmuch as the contract stated that the sawmill was to be erected "at the U. S. Navy Yard, Mare Island, Calif.," the structure might be placed anywhere in the navy yard that the Government might wish, and the contractor was without just cause for complaint if any available site were selected. Since the contract contained a clause providing that upon the report of a board of officers of the Navy, showing that the progress of the work was not such as to indicate that it would be completed within the time specified, the Government would have the power to annul the contract and complete the work at the expense of the contractor and his sureties the Supreme Court held that upon the contractor's refusal to build on the site finally selected it was entirely proper for the Government to exercise the power of annulment and relet the work. It held, on the other hand, that before the Government could recover the excess cost of completion from the first contractor, it was necessary for the work to be completed in substantially the same manner as was contemplated in the first contract. It was held by the Supreme Court in the Axman case, decided in 1914, and reported in 234 U. S. Reports, p. 36, that "Where, after default of the original contractor, the contract is relet, the original contractor is not bound for difference unless the contract as relet is the same as the original contract."

This principle was applied to the case in question, although the new contract was made on substantially the same specifications as the old, because by supplemental agreements the Government made a number of important changes, involving particularly the length and size of the foundation piles used, and making a difference of about 6% in the total contract price.

The court also held that the Government must pay for materials brought upon the ground by the bridge company, which had been seized by the Government after only partial payment had been made.

The case was argued in November last, by George A. King, of King & King, for the contractor, and Assistant Attorney General Houston, for the U. S. Government.

Cement Plant Again Under Municipal Control

The portland cement plant built for the production of cement for the Los Angeles Aqueduct has again returned to the possession of the City of Los Angeles. The Public Service Department of the city on Sept. 27 took possession of this plant, which had been under lease for the Board of Supervisors of Los Angeles County.

Malaria-Control Engineering in Texas Increases Labor Efficiency

Mosquito-Prevention Work Done Along a Large Railroad—Dallas Eradicates Anopheles Mosquito Haunts by Draining, Clearing, Oiling and Stocking Streams with Minnows—Lives and Dollars Saved at Small Expense

BY CHARLES SAVILLE
Director of Sanitation, City of Dallas

AND

H. W. VAN HOVENBERG
Sanitary Engineer, St. Louis Southwestern Ry.

MALARIA-CONTROL engineering is a relatively new field for engineers engaged in health protective activities. It combines opportunities for original research with a return on the financial investment that is prompt and certain.

Malaria undoubtedly ranks first in practical importance among endemic diseases in the Southern states. The U. S. Public Health Service estimates that 4% of the population of the 13 Southern states suffer annually with the disease. Careful surveys recently made in three east Texas counties showed that in some localities 50 to 70% of the rural population were infected, and that the annual cost of the disease per family, for doctors' fees, medicine and loss of wages, amounted in some cases to from $80 to $100. It is thus clear that the presence of malaria in a community may often become a decided drawback to commercial and agricultural development as well as to military preparedness.

DALLAS CUT MALARIA TWO-THIRDS

It is now known that malaria is spread from an infected person to a person in good health by the bite of the female of a particular variety of mosquito, the anopheles, who lays her eggs on clean, quiet water surfaces, preferably in protected spots along grass-covered edges of streams or pools. The practical solution of the malaria problem is found in ridding the infected area of the breeding places of the mosquito. The City of Dallas, Tex., undertook this method of malaria control in the summer of 1916. After a year of intensive work, costing 3c. per capita, the death rate from malaria decreased 66.7% and the number of cases of the disease reported to the health department fell to an average of only two or three per month. Any community may obtain like results.

During the year that ended Aug. 1, 1916, a total of 27 persons died in Dallas of malaria, or more than died of scarlet fever, diphtheria, measles, smallpox, spinal meningitis and infantile paralysis combined. It is estimated that possibly six of these 27 victims were non-residents. As the accepted ratio of deaths to cases of sickness is approximately 1 to 400 for this disease in the United States, these 21 city deaths indicate that approximately 8400 persons in Dallas suffered from malaria during the year. From May to December, 1916, 163 patients were treated for malaria at the city charity hospital, at a cost of about $2000, which was a tax half as great as the cost of successful malaria-prevention work for a year.

WHAT GOULD DID ON THE SOUTHWESTERN

The St. Louis Southwestern Railway Co. may be taken as an example of a large and progressive business corporation that has recognized the value of malaria eradication. A recent study of health conditions on the railroad, and in the large employees' hospital, convinced Edwin Gould, chairman of the board of directors, that the malaria situation was acute. As a result he provided from his own purse a trust fund amounting to many thousands of dollars for fighting the malaria mosquito and for improving health conditions among the fifteen thousand employees of the road living in the states of Missouri, Arkansas, Illinois, Louisiana and Texas.

MALARIA REDUCTION A MILITARY PROBLEM

The location of army cantonments and aviation schools in the South and the concentrating of enlisted men in many towns has called for prompt action to protect our soldiers from malaria. At all encampments this malaria problem is receiving attention from the regular Army authorities, while some of the communities adjoining the encampment sites are getting rid of malaria through the coöperation of the U. S. Public Health Service, the American Red Cross, and the state, county, and municipal authorities.

Even in those communities which have no malaria problem of consequence the mosquito pest is being given consideration, for it is obviously impossible to put troops through grilling hours of training unless they have proper sleep. Press dispatches indicate that the work on the cantonment site at Yaphank, N. Y., was delayed seriously because laborers refused to work in opposition to the swarms of mosquitoes. One of the writers recently discovered ordinary house mosquitoes (not the malaria-bearing variety) breeding in enormous quantities in the basement of a large armory in which several hundred soldiers were quartered. These men had just been vaccinated for smallpox and immunized against typhoid, and many were in wretched physical condition, because the mosquito pest made rest imposible.

FORTY MILES OF MALARIA-BREEDING STREAMS CLEANED UP

The malaria situation in the City of Dallas was acute at the time the malaria control work was begun. In an area of about 17 square miles there were some 40 miles of water courses favorable to the development of mosquitoes, with the possibility of spreading malarial infection among the 140,000 residents of the city from the beginning of the mosquito season in May to the cold weather of November. The natural topography of Dallas facilitates the draining of standing water and the training of streams to give them sufficient fall. There were many large resident districts of the poorer class that were sorely beset by mosquitoes because they bordered creeks that had never been properly cared for. Several of the largest parks were also located along streams where thousands of people seek recreation after

nightfall, only to fall prey to the disease-carrying mosquito that ordinarily is "on the wing" at dark, but gives no warning of her presence, because she does not make the same loud humming noise that is characteristic of the more common rain-barrel mosquito.

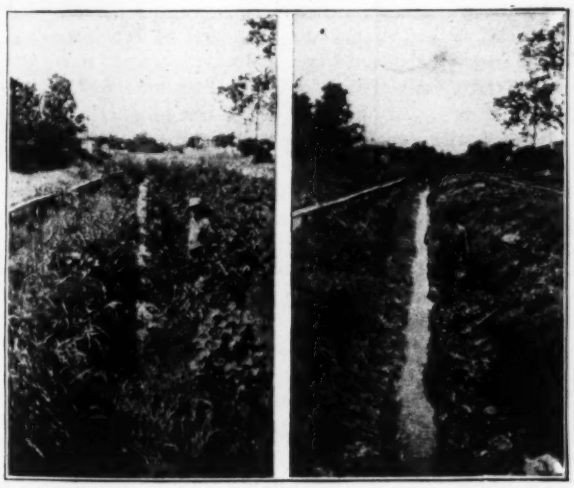
The writers believe they are conservative in their opinion that before the inauguration of the malaria-control work Dallas was well within the average of 4% infection annually for inhabitants in the 13 Southern states, estimated by the U. S. Public Health Service.

How Dallas Did It

With this situation, then, malaria-control work was started in May, 1916, the work being carried on by the division of sanitary engineering of the department of public health under the supervision of the writers. The field equipment included short and long handled shovels, hoes, trench spades, picks, rakes, grass-cutting tools, axes, storage oil barrels, 5-gal. oil cans, two Meyers Bros. No. 330 G. I. knapsack sprayers, and a Ford runabout equipped with a delivery wagon body.

In order that Dallas might benefit fully from the experience of other places in this particular line of work, the active coöperation was secured of the Malaria Field Investigation Branch of the U. S. Public Health Service, whose trained physicians and sanitary engineers have fathered the Dallas work through regular visits to the city, and through aid given in every possible way to the local public health officials in their conduct of the work.

Attention was first given to those portions of the creeks and ponds that were active anopheles breeding places, and then extended to include all important mos-



CLEANING THE SIDES AND BOTTOM OF THE STREAM DESTROYS MOSQUITO-BREEDING PLACES.

quito breeding spots. The work consisted in both cases in:

(a) Clearing of banks of grass, weeds and débris, to destroy shelters and facilitate ditching and oiling.

(b) Ditching of streams to get channels of minimum cross-section, with sufficient stream flow to keep the channel scoured.

(c) Filling large holes situated under bridges and at ends of culverts, pot holes in creeks, over-flow pools, etc.

This work was followed by oiling water surfaces at regular intervals or, where feasible, by stocking with, or cultivating the growth of, top feeding minnows in streams and ponds.

The field work embraced six main streams having a total length of 30 miles and an average high water channel width, before the work started, of approximately 30 ft. Extensive marshy areas were also drained by ditches, several thousand feet in length, reclaiming many acres of valuable land for agricultural and business purposes. The field force comprised five to ten men during the summer months. They were paid 25c. an hour in 1916, and 30c. in 1917.

Creek Bottoms Swept with Brooms

Algae growth and moss were removed from the creeks by sweeping with a stable broom. Attractive sign posts giving police warning were erected to discourage throwing of trash in streams and to prevent mischievous boys from building dams. A municipal ordinance was adopted to compel the removal of mosquito-breeding areas on private property. Along with actual field work, an educational campaign was carried on through public lectures, health department publications and exhibits. Some little work was also done on a malaria index with microscopical examination of specimens of blood taken in various parts of the city. Thirty per cent. of the inhabitants of the Mexican quarter that were examined were found infected with malaria parasites of the tertian type.

Approximately 30 of the 40 miles of creeks under control proved to be regular anopheles breeding areas, which had to be continually recleaned and retrained. About 300 gal. of a compounded oil were used monthly. The oilers waded down the creeks with knapsack sprayers on their backs, replenishing their supply of oil at regular filling stations. The cost of field work on the six principal streams, including all supplies, wages, automobile expense, and supervision, during the active mosquito season, averaged about $16 per month per mile.

Lives and Dollars Saved

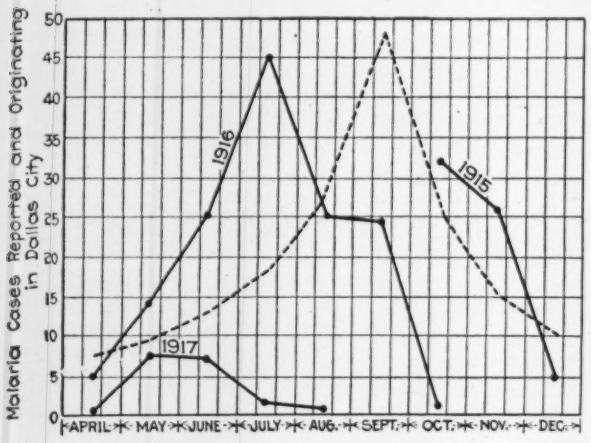
The value of any health activity is judged by the decrease in the number of cases of sickness and in the reduced death rate. The records of the Dallas city registrar show that there were 27 deaths in Dallas during the year ending Aug. 1, 1916, which was before anti-malaria work was well started. During the following 12 months there were only nine deaths from malaria, a reduction in mortality of 66⅔%, despite a material increase in population. Assuming the value of a life to be $3000 and the cost of an average case of malaria, for medicine, attendants, and wages lost, to be $25, and using the ratio of one death to every 400 cases, we find a probable economic saving to Dallas inhabitants through reduction in the disease to have been nearly $200,000, or about $1.25 per capita. Compare this saving with the 3c. found to be the actual cost per inhabitant of effectively controlling malaria. What other investment yields so great a return?

An indication of the reduced prevalence of malaria in Dallas is shown by the records of the City Charity

Hospital. Only four patients were treated for this disease in July and August, 1917, as compared with 85 such patients in the same months in 1916.

The increased tendency of Dallas people to spend their holidays at public and private recreation centers about Dallas led to the control of anopheles breeding at a municipal fishing and picnic grounds situated some six miles from the city, which had always been known as a place where many of the Dallas malaria fever cases originated. This area is now under control, is becoming more popular every day and has ceased to be a source of infection of Dallas people. At the present time the prevention work is being extended to afford protection to the aviation camp which is located close by.

It is not claimed, of course, that all of the greatly reduced malaria prevalence observed in Dallas during



MOSQUITO-CONTROL ACTIVITIES MATERIALLY REDUCED MALARIA IN DALLAS, TEXAS

Dotted line shows normal seasonal distribution of malaria in north and east Texas as determined by the U. S. Public Health Service in communities where control measures are not in force. Full lines show seasonal distribution in Dallas before and after introduction of control measures. The breeding places of the malaria-bearing mosquito were first brought under control about July 15, 1916. Observe that apex of curve for 1916 was reached in July instead of September, showing how rapidly reduction in prevalence of the disease follows malaria-control activites.

the past year is directly the result of the health department's activities, because in problems of this sort there are usually special factors involved; but it must be evident to anyone who has carefully considered the greatly improved conditions found throughout the city, and their practical value to the taxpayer, that the recent expenditures for anti-malaria work have already been repaid many times. A low death rate is a far better investment than a low tax rate. Systematic malaria-control measures in any community should in fact be looked upon as a paying business investment, and, what is still more important at this time, as a definitely patriotic duty.

Chicago's Building Industry and the War

What are Chicago's reasonable requirements as a war-material center for internal growth? This is the intent of the industrial survey which a committee of the Chicago Association of Commerce has under consideration. This investigation, which is the result of a meeting attended by engineers, bankers, architects, material dealers and others, will take up the following points: Demand for buildings, financial aspect, cost and supply of material, legislation and labor.

Irrigation Project Is Based on Economic Use of Water

Limited Supply Necessitates High Duty—Standard Dam Section Employed in Comparing Reservoir Sites

ORGANIZATION of an irrigation district in the Victor valley, California, "along such lines as shall best make for economic use of the water available," is the subject of a report to the Board of Supervisors of San Bernardino County. This report was submitted in August by the Mojave River Commission composed of W. F. McClure, J. A. Sourwine and C. E. Tait. Mr. Sourwine is county engineer.

The Mojave River constitutes the chief drainage system on the north slope of the San Bernardino mountains. Its flow is periodic, and the lower levels of the stream go entirely dry in the summer. The governing condition is a limited quantity of water and plenty of land. Therefore, the problem for the district was not, how to deliver water upon any particular land, but rather the development of a project giving actual and reasonably immediate use of water on some land within the valley. The commission had to consider the agricultural and land development aspects of the situation as well as the more strictly engineering subjects. Small units of development are considered necessary for a successful initial project in the Victor valley.

Duty of Water for Irrigation

The crops on the greater part of the land must be such as to permit a high duty of water, in order that the water available may be made to serve the maximum area, and in order that the acre-cost of the irrigation works may be reduced to a minimum, so as to make the project financially feasible. It is recommended, therefore, that the valley be utilized for the production of deciduous fruits (such as apples and pears), so that any irrigation system need provide only the less amount of water required for such fruits instead of the greater amount that would be required for alfalfa.

Investigations of 49 orchards in nine districts, with a total area of 1330 acres, show an average of 0.82 acre-feet of water per area. The maximum was 1.79 and the minimum 0.33. Classifying the orchards with regard to ages of trees, the amount averaged 0.62 acre-foot per acre where the trees are less than five years of age, and 1.11 acre-feet where they are over five years. Only two to four irrigations per year are required for such orchards.

As to the duty of water, it is recommended that this should be estimated at 1.25 acre-feet per acre for the west mesa and 1.50 for the east mesa, the latter having a slightly lower rainfall. No allowance is made for loss in distribution. On the other hand, no account is taken of the land that would be devoted to buildings and therefore would not require irrigation. This item is taken as 15% in the estimate of cost. It is considered that these two items would balance approximately, so that the duty recommended above would determine the gross area that may be included in a project.

The average annual run-off of the Mojave River, where it enters the Victor valley basin, is approximately 90,000 acre-feet. About 33% of this is avail-

able for storage by the West Fork reservoir project. The above average is deduced from a study of rainfall records for a period of 18 years, which includes one year of low flow. The range of the annual records during this period is from 13,378 to 169,935 acre-feet.

Underground water may be pumped to serve certain portions of the district, but a gravity supply of water is necessary for the irrigation and reclamation of the greater portion.

Study of Soil Moisture

Investigation of the amount of moisture that should be maintained in the soil has been made in order to determine the "wilting coefficient" of the soil—that is, the minimum percentage of moisture which will keep plants from wilting. This coefficient multiplied by 1.84 gives approximately the percentage of moisture supplied by an irrigation. The report states that the moisture should not be allowed to fall below this coefficient during the growing season, and the closer it is maintained to the coefficient multiplied by 1.84 the better the results should be.

To determine the "wilting coefficient," borings were made to depths of 6 ft. or more, soil samples being taken at 1 ft. intervals. This depth is considered sufficient for the roots of deciduous fruit trees. For the east mesa the average was 6% (3 to 9.6%), while for the west mesa it was 5.3% (3 to 8.1%). The water required to produce a moisture content above the wilting point is 0.52 acre-feet and 0.45 acre-feet, respectively.

Standard Cross-Section for Dams

Dams are required for the two reservoir sites selected on the West Fork. To obtain some standard for comparison an "excessively safe" section of gravity dam was assumed, all dimensions of which were expressed in terms of the height (H). The width for 0.20 H from the top is 0.15 H. The section then widens in the form of a trapezoid to 0.65 H at the base. The area of cross-section is 0.33 H^2.

Putting this area in terms of only one variable, the height, does not offer the most effective or economic section, but it does offer for purposes of preliminary study a section of sufficient strength and one allowing of comparison with other dams. From cross-sections of the dam sites and by assumption of the above arbitrary cross-section of dam, an estimate was made of the yardage for the respective dams, for varying depths and varying capacities.

In order to present the results in the forms of a cost curve, rather than a curve of concrete yardage, a unit cost of $6 per yd. was assumed for all concrete to be used in dams. The cost of the respective dams was then computed for varying heights from 10 ft. to 150 ft. and the capacity for the same height was determined. The total cost of each height was then divided by the capacity for that height, and the unit cost for the given capacity was obtained. These various unit costs for different capacities were plotted on cross-section paper, and were found to lie on a fairly uniform curve. A smooth even curve line was drawn through the points then determined, and a unit-cost curve was thus obtained for varying capacities of each reservoir.

The economic upper limit of storage for one reservoir was found to be 35,000 acre-feet, and the cost for this would be $34.50 per acre-feet. At the same cost the upper limit for the other reservoir was 34,000 acre-feet. Taking this price as the limiting economic value for unit cost, the lower limit of economic storage was found to be 28,000 and 9400 acre-feet respectively.

Either of these reservoirs is suitable for the first initial project which may be developed. The report states that it is gratifying to find such possibilities for economic storage based on such small project units. It is on these small project units that hope is based for a successful initial project in the Victor valley.

For the ultimate development of the West Fork run-off a much larger storage is desirable, and for this the commission considered a possible combination of the two reservoirs. An economic cost-curve was prepared, and this indicated several interesting features.

As an instance, it showed a remarkably wide range of storage possible through economic combinations of the two reservoirs, without any wide variation in unit cost. By proper economic combination of the two reservoirs, a combined storage of 60,000 acre-feet can be obtained at a unit cost of approximately $33.25 per acre-foot, while a combined storage of only 66⅔% of this amount, or 40,000 acre-feet, can be had for $33.50 per acre-foot or approximately the same cost. There is an intermediate between the two values, of 52,000 acre-feet storage, at a unit cost of $32.85 per acre-foot, while a decrease of the total combined storage to 31,000 acre-feet serves to increase the unit cost only to $34 per acre-foot or less than 4% above the intermediate condition. The report points out that this indicates a possible flexibility of design which is very desirable and which is seldom obtained.

Economic Area for Development

In the development of a practical initial project, the area to be first put under cultivation is an important item. The report points out that if the project is too large it becomes unwieldy. It is then difficult to carry and develop it within the period during which development must take place if the project is to become self-supporting before it collapses from carrying too much dead weight in the way of non-productive and non-remunerative acreage. On the other hand, if the project is too small it will generally reach a limit where the first cost is too high and the overhead proportionately large, and the resultant unit cost will be prohibitive to success. Where a project can be found which offers nearly equal unit cost for varying degrees of magnitude and growth, the conditions are unusually favorable to successful development.

This appears to be the case with these upper West Fork reservoirs. Still, there is a practical limit to the small initial unit of construction, to go below which would necessitate unnecessarily heavy costs for additions to the project, as it became desirable to increase development. The commission is of opinion that the approximately effective size of such an initial project should be from 15,000 to 18,000 acres.

Recommendation and Cost

The commission recommends for the first unit the completion of the larger reservoir to a capacity of 33,000 acre-feet, which will allow a safe annual draft of about 20,000 acre-feet. With a duty of 1.25 acre-feet

this will supply an irrigated area of 16,000 acres, or an irrigation district of 18,400 acres (allowing 15% for lands not cultivated).

The estimated cost is $1,705,300, divided as follows: Dam, $1,125,300; spillway, $20,000; land, $40,000; feeder system, $198,000; distributing system, $322,000. Interest charges during a two-year period of construction would bring the total cost to $1,797,800, or $97.70 per acre. As this estimate is based on the arbitrary section of dam noted above, it is expected that a final estimate would be 10 to 15% lower, giving a unit price of approximately $90 per acre, including interest charges.

Pressure on Inclined Cuts of Timber by Simple Diagram

By C. A. Melick

Associate Professor of Civil Engineering, Michigan Agricultural College, East Lansing, Mich.

THE subjoined diagram for Jacoby's formula, which I find to be quite a timesaver in the design of timber details, is constructed as follows:

Lay off AC equal to the unit-stress permitted for bearing on the ends of the fibers, and CB equal to the corresponding unit-stress across the fibers. On AB as a diameter erect a semicircle. Through C and A draw a series of parallel lines such as CF and AD. Project D, the point where AD cuts the semicircle, on the diameter AB, giving point E. With C as a center and CE as a radius, swing arc EF, cutting line CF at F. Then CF equals the allowable unit-stress on a surface AD inclined to the fibers AB of the timber at an angle $\theta = DAB$.

As will be noted from the diagram, $CF = CE = CA - AE = CA - AD \cos\theta = CA - AB \cos^2\theta$. Using the notation given in Jacoby's "Structural Details," page 254, $CA = S'$ and $AB = S' - S''$, then $CF = S' - (S' - S'') \cos^2\theta = S' \sin^2\theta - S'' \cos^2\theta$, which is Jacoby's equation for the permissible unit-stress on a surface inclined at an angle θ to the fibers. By constructing a curve through a well-selected set of points F and drawing concentric circular arcs with centers at C for rapid interpolation of allowed units, the diagram is complete.

To use the diagram, let it be required to find the allowed unit on the truss-joint surface CG in the small sketch. Place the base AC of the diagram (which should be constructed on transparent material) to cover the fiber AC of the stick with whose fibers the cut BC makes the smallest angle, in this case the horizontal stick. Then read, at the point where CG (or CG produced) cuts the curve, the allowable unit-pressure in pounds per square inch.

The ease with which such a diagram can be constructed and the fact that two curves, one for a common soft or cheap hardwood and another for oak blocks, may be readily constructed on the same diagram makes the device especially convenient. I prefer a diagram drawn to a scale of 1 in. = 400 lb. per square inch.

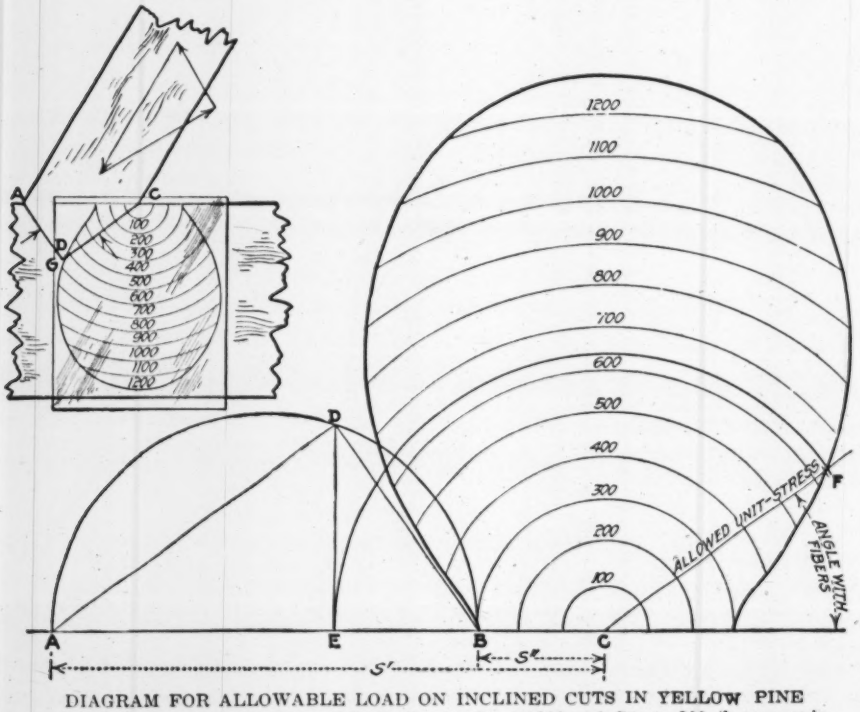


DIAGRAM FOR ALLOWABLE LOAD ON INCLINED CUTS IN YELLOW PINE
For Jacoby's Formula, $S' - (S' - S'') \cos^2\theta$, with $S' = 1300$ and $S'' = 300$ lb. per sq.in.

Motor Trucks To Be Used for Parcel-Post on Star-Routes

Within perhaps the next three months motor truck parcel-post routes, aggregating between 3000 and 4000 miles, will be in operation in various parts of the country.

One chain of motor routes will extend from Portland, Maine, to New Orleans. Another will cover much of a large stretch of territory in Ohio, Indiana, Illinois and West Virginia.

On the Pacific Coast routes will be established between San Francisco and Sacramento, and between Redlands and Los Angeles, California.

The existing law does not provide for the employment of Government-owned motor trucks on rural-delivery routes, nor does it require the rural carriers to use motor vehicles in the service of such routes.

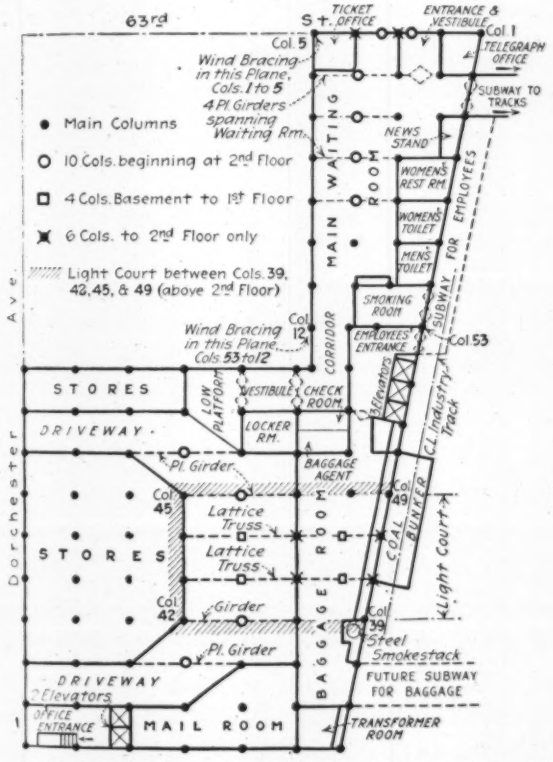
In the star-route service, however, where the mail is carried under contract, a recent law permits the Post Office Department to designate the sort of vehicles to be employed, and in awarding new contracts the department will specify that motor trucks shall be employed on all routes where the roads are such as to admit of their use. These contracts are advertised for bidders, and where payment asked for the service is deemed to be excessive the department is authorized to provide Government-owned motor trucks and to employ drivers for the operation of these routes.

Railway Station Is Combined with Tall Office Building

Illinois Central Moves Some of Chicago Offices to Suburban District—Building Has Steel Frame and Ribbed-Slab Concrete Floors

TAKING advantage of the lower land values, the Illinois Central R.R. has recently erected a large office building in a suburban district, utilizing the main floor as a passenger station. The building is adjacent to the right-of-way at 63rd St., a stopping point for both through and suburban trains. The company's present down-town office accommodation is overcrowded. As the work of the accounting department does not need to be in close touch with the city offices, it was decided to erect a special building at 63rd St. for this department and to utilize this also as the new station.

The building is nine stories high, but designed for an ultimate height of 13 stories. It is of irregular shape



PLAN OF COLUMN LAYOUT AND STATION FLOOR OF OFFICE BUILDING OF ILLINOIS CENTRAL R.R.

(see plan), with a frontage of about 300 ft. on the railway, and is set back far enough from the elevated main tracks to permit of laying an industry track between them and the structure. This track will serve also for the handling of coal, ashes and supplies at the building, as indicated on the plan.

The building was erected during 1916-17. It was designed by D. F. McLaughlin, architect for the railway, and the construction was in charge of Frank R. Judd engineer of buildings. The design and construction were under the direction of A. S. Baldwin, chief engineer of the Illinois Central R.R. The contractors were the Henry Ericsson Co., for the foundations, and James Stewart & Co., for the superstructure.

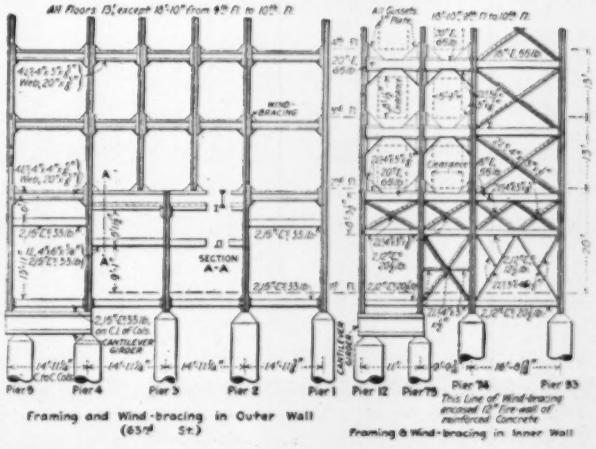
Nearly the whole of the first floor is given up to station facilities and stores. On the second floor is a lunch room and cafeteria for the use of the public and the employees. This is equipped for serving lunch promptly to a thousand persons. The upper floors are devoted entirely to the various branches of the accounting department.

An entrance for employees is provided on the track side of the building, a subway connecting this with the transverse subway which gives access to the platforms. On the Dorchester Ave. side is a carriage entrance leading to a driveway loop, which is paved with creosoted wood blocks. An entrance for pedestrians, at the narrow end on 63rd St., leads directly into the waiting room, close to the subway extending under the tracks. This entrance being most convenient for suburban passengers, the principal station facilities are left free for main-line passengers.

The upper floors are of the loft type, with no interior walls except for a few special departments. The wing is utilized as filing space for records, and is separated from the main portion by a 12-in. wall with firedoors. There are five hydraulic elevators. One set, at the railway side, has one for freight and two for the employees. The others are near the street entrance to the offices. Stairways are inclosed by firewalls to permit reducing the number of fire escapes. The latter are iron stairways with full treads.

The heating and ventilating plant will provide for delivering washed and tempered fresh air. A circulating system will provide cooled drinking water. The boiler and engine room are in the basement, under the baggage room, and a 6-ft. steel smokestack extends up through the building.

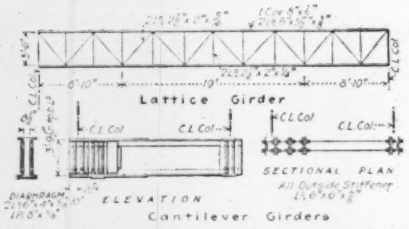
The building is of steel-frame construction. It is founded on concrete piers, some sunk to rock at 60 ft.



STEEL FRAME AND TWO SYSTEMS OF WIND BRACING

below street level and others sunk only to hardpan at 25 to 30 ft. At the property lines the centers of the piers are set back 3 ft. 3 in. from the property line, and the exterior columns are carried on cantilevers, as shown in one of the drawings. These consist of heavy box girders incased in concrete. Their cantilever arms are 25 in. long, and are seated on fulcrum castings similar to the column base castings. All piers carrying these cantilevers are founded on rock.

The basement is 7 ft. below city datum (water level), and special care was made to have it dry and watertight. Its floor is made of two separate 6-in. layers of concrete. No waterproofing medium is used, and the concrete is the 1:2:4 mix employed throughout the building. In this floor, however, a specially dense mix was obtained by using reground cement. This was of



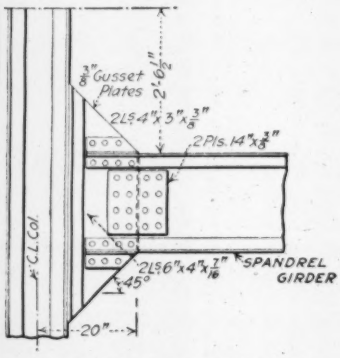
CANTILEVER FOUNDATION GIRDERS FOR LIGHT COURT

such fineness that 98% was passed by a 200-mesh sieve.

The windows are of the Wilson "Reverso" type, in which each sash is reversible, so that both sides can be cleaned from the inside. These are made by the McFarland Hyde Co., of Chicago. Galvanized-iron frames and sash are used, with wire-glass panes where required by ordinance.

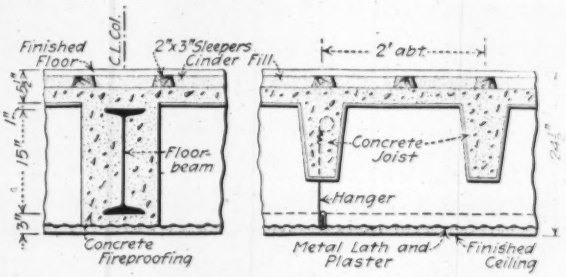
The steel columns are of H-section. The waiting room and the driveway are spanned by heavy plate-girders to carry the intermediate columns of the upper floors. Above the second floor is a large light court. A skylight at the bottom covers part of the driveway and the baggage room. This is carried by lattice girders on columns which extend only to the second-floor level.

The wind-bracing arrangement is shown in one of the drawings. The narrow tapering wing has wind-bracing in both ends. At its 63rd St. front (64 ft. wide) this consists of gusset plates between the spandrel girders and the columns. At the 34-ft. end, joining the main building, diagonal bracing of pairs of angles is used. These are embedded in the firewall, and provide a clearance of 5 ft. 9 in. x 8 ft. 1½ in. for openings. In the main building, certain floors have horizontal wind-bracing consisting of struts composed of pairs of channels, and diagonals composed of pairs of angles. These are embedded in the concrete slab.



WIND-BRACING CONNECTIONS

The concrete floors are of the ribbed-slab type built with Berger trough forms, as shown in the detail. The panels average 16 x 18 ft., and the ribs or joists are spaced 24 in. c. to c. They are designed for a floor load of 75 lb. per sq.ft. in the office space and 150 lb. in the filing space. The roof is of similar construction, as it will form the future tenth floor. It is covered temporarily with a cinder fill having a cement finish, on which an asphalt built-up roofing is applied. The solid parts of the roofs of the light courts have a finished surface of concrete on the cinder fill. The floor concrete is covered with a 3-in. cinder fill in which are embedded wood



RIBBED-SLAB CONCRETE FLOORS

sleepers or nailing strips for ¾-in. edge-grain yellow-pine flooring.

The concreting of the floors was carried on during the winter. The concrete materials were heated, as is usual in such cases. To prevent freezing of the concrete in place, the sides of the building in the story above and below the new floor slab were inclosed with heavy canvas. Salamanders were placed inside, and the completed floors were covered with straw. The falsework and forms for floors were left in place for about three weeks.

Virtually all the concrete was proportioned 1:2:4. The concrete mixing plant was placed between the railway and the building. The concrete was dumped from the mixer into wheeled carts which were hoisted in an elevator tower and run into the building. This tower was at one of the outer corners of the light shaft.

Missouri Puts Convicts on Roads

The use of convict labor for road work was begun recently in Missouri by the State Highway Department, and the first camp has been established at Mineola. The Mineola special road district had voted bonds to pay half the cost of constructing the eight-mile link of the National Old Trails road within the district. Finding it impossible to secure local labor, the district induced the county court to make application for 30 men from the state prison. Of these, 25 are employed on the road and five for cooking, laundry and camp work. The road district pays the State Prison Board $1.25 per day for each man actually engaged in road work, and the State Highway Department will reimburse the district for half this expense as the work progresses. The $1.25 covers the cost of housing, boarding and transporting the entire camp, and also includes the salary of a foreman supplied by the prison board, and the services of the cooks and other men required to maintain the camp. Only "honor men" are employed. They work without guards and do not wear prison uniform. To obtain this labor, application must be made through the county court to the State Highway Department and the State Prison Board.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Exhibits Speed Up Conversation

Seeking to make easier the conversation between its members and guests, the Western Society of Engineers has been using exhibit boards with the idea that engineers are naturally not good mixers and need some ready-made topic with which to begin an acquaintance. It is held that the young man especially will find it much easier to get acquainted when a concrete subject of interest to both parties to a conversation is at hand.

Four sheets of 4 x 8-ft. wall board into which thumb tacks press easily are covered with photographs or drawings showing something of news interest. About 100 pictures, including a number of panoramas, of the army cantonments were used as a start. War maps are posted. Views of army transport service, both here and in France, utilizing trucks and trailers made up another board. Drawings issued by the U. S. Departments of Commerce and Labor and used in teaching shipbuilding to carpenters and other artisans were sent by K. G. Smith, director of engineering extension, Iowa State College, who had the matter in charge. The British recruiting station in Chicago has promised to furnish for an evening an exhibit of war relics and of photographs taken in action. Once it became known that the committee having the matter in charge desired such material, plenty of it was made available.

Employment Activities of Two Societies

Since 1910 the Boston Society of Civil Engineers has had a bureau of employment for its members. Two lists are maintained, one of men desiring work and the other of available positions. Each man is given a number, and his record is published in the society's monthly journal. Positions open are also published, if requested, but usually the length of time which elapses between the filing of requests and the publication of the journal is too long for employers to wait. It is reported that this system has been successful, and that a considerable number of men each month obtain positions in this way. However, owing to the tremendous demand for engineers on war work, the bureau now has little to do.

The Western Society of Engineers, Chicago, maintains a similar service, except that its lists are published in a monthly news bulletin issued separately from the journal. This service is handled in a systematic way, but some changes are to be made in the routine. Cards indicating positions wanted and vacant are posted on the bulletin board in the rooms and a start has been made by the secretary toward getting in touch with the employment departments of various companies in Chicago.

Applicants for positions are requested to fill out record sheets which are filed subject to inspection on application to the secretary. Specification sheets of positions open are required of employers.

The applications of fifty men and as many positions open are on file at present. A special service recently rendered to the U. S. Quartermasters' Corps consisted of obtaining 25 engineering applicants for civilian duties.

The question of bringing down to date the service records of all members of the society, by means of a suitable questionnaire, is under consideration.

With a few other notable exceptions, this feature of practical society service is handled in a spasmodic and rather unsystematic way. *Engineering News-Record* is of the opinion that more can be done without placing undue burdens on the secretaries, and invites discussion of ways and means of furthering the service.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Should Engineering Students Be Drafted?

Sir—The new rulings promulgated by General Black relating to engineering students will, if I understand them, make every student of military age and physically fit subject to draft, but those who come up to the required standard will be given special training to fit them for special military engineering.

This seems to be a very sensible way of making those of special ability into military engineers. It gives those who have real red blood a chance to show it, and at the same time allows them to finish their education. If this awful war continues we will need them all, for our sons must bear the burden which we old fellows can no longer carry.

There are many students, I am sure, who would gladly enlist but for the fear, not of the Boche, but of going through life with no chance for an education. This new ruling gives them the chance of an education and also allows them to prove their willingness to "do their bit."

F. J. MACISAAC.

New York City.

What Is the Matter with a College Education?

Sir—"There is nothing the matter with a college education," is the only answer of every graduate and college student to the query of M. J. Henoch, which appeared on page 48 of your issue of Jan. 3.

A college graduate is just as human and as near mortal as a pile-driver or dock-builder foreman in that he too must start at the bottom of the ladder. The graduate, however, has the advantage in that his climb up the ladder will be made easier, more certain—and the ladder will be higher than that of the pile driver. The two ads quoted by Mr. Henoch will prove in themselves that the college graduate has the better position, when all things are considered. After two years out of school the graduate is offered $10 per week in a permanent

position and, the chances are, with a company stronger financially than the contractor. In addition he is given every opportunity to advance.

True it is that the pile driver now earns $60 per week; but how many years of experience are necessary to qualify him for that salary? The average pile driver who earns $60 per week is 35 or 40 years old, and 22 or 23 is the age of the college graduate. This same pile driver, probably starting in as an apprentice machinist or general roustabout, was glad after his first two years of work to be earning $12 or $15 per week. These figures, at least, held true before the conditions of war raised common day wages to their present level. Furthermore, the pile driver has a job only good until the completion of that one contract, when he must hunt another job. When hard times come the pile driver is in a line of business among the first to be affected.

Does Mr. Henoch believe that the college graduate after the same number of years experience will be limited to $60 a week?

PAUL J. KEELER.

Akron, Ohio.

Flange Bracing of Through Girders Needs More Discussion

Sir—The bracing of the top chords of plate girders and trusses has three important duties: 1. To carry the wind pressure; 2. To resist centrifugal forces; 3. To stiffen the chords. Provision necessary for (1) and (2) is well standardized. On the other hand very little is known in regard to (3), which is involved in the discussions p. 470, Sept. 6, and p. 1074, Dec. 6, 1917, of *Enginering News-Record.*

The writer while still at college constructed several model pasteboard bridges. During his teaching this work was continued in the stronger materials, wood and steel. One model, now in the author's drawing room, is 21 ft. long and 3 ft. wide, representing to one-sixth scale a steel highway truss of 125-ft. span. It has $\frac{1}{8}$-in. rivets and $\frac{1}{16}$-in. pins, the latter being employed at the shoe, which at one end of the bridge are fixed and at the other have roller nests. In fact the steel and timber models were made with scrupulous care to keep the details like those in practice except as to size. The importance of bracing for stiffness has been well demonstrated by these models. All of them, even those of pasteboard, showed marked instability under their own dead weight until the proper lateral bracing was inserted.

It would be safer to assume the responsibility for a thoroughly braced steel highway truss bridge with the stresses ranging around 20,000 lb. per sq.in. than for one with deficient lateral stiffening where the more normal unit-stress of 15,000 prevails.

In many structures, bracing for wind will provide sufficient stiffness. For one thing, it is seldom that (1) and (3) will approach their maximum at the same time, and the two loadings, speaking very roughly, cause about the same stresses. In very large structures, however, this question becomes very important, and similarly in those where the combined forces are likely to act simultaneously, for those where stiffness is very important (as in railroad bridges with their large impact factor), or in those where there are no wind stresses (as in some building work). With these exceptions in mind, the writer has ventured in the "Design of Simple Structures" to offer the following rules:

"Where the ends of the chords are held firmly in position, as in the usual elevated railroad construction with the longitudinal girders framing into the cross-beams, provide for a transverse load equal to one-thirtieth of the safe compressive strength of the chords considered as short struts. Use the average section if the composition varies from point to point.

"Where the ends would be free to turn except for the bracing provided, as in through plate-girder bridges, design for a transverse load equal to one-tenth of the safe compressive strength of all compression chords considered as short struts."

Most questions of design in structural work are pretty well standardized. Various methods have been employed, considered theoretically, and discussed among engineers until loads, analysis, allowable stresses and so forth are fixed to a certain extent. But, as indicated by Mr. Conklin's excellent article, current literature contains but one reference to this subject. It seems therefore that an extensive discussion of the subject might throw added light on the subject. Examples of bridges which have failed through lack of lateral stability should prove very instructive. It is especially desirable that such structures be compared with the requirements of the above rules or of any others which might be suggested.

It is particularly felt that young engineers cannot hear too much about stiffness and rigidity in structural design, for they are prerequisites for durability and safety.

HORACE R. THAYER,

Pittsburgh. Carnegie Institute of Technology.

Success of Treeplanting Device

Sir—In *Engineering News* of Mar. 15, 1917, p. 432, there is an article by Hugh Smith, Minneapolis, which describes a tree planter developed by me, and used by the Minneapolis, St. Paul & Sault Ste. Marie Ry. in planting trees along its tracks.

When this article was printed the machine was still in the experimental stage, and only one had been used. We were not ready then to say just what the results would be.

It can be said now that the trees planted in 1916 grew splendidly in 1917, in spite of the dry weather, and two more machines were built last spring. This year more than 5,000,000 trees were planted. The last machine was built as an attachment to a tractor.

T. A. HOVERSTAD,

Agricultural Commisioner, Minneapolis, St. Paul and Sault Ste. Marie Ry.

Minneapolis.

Building Hydroelectric Plants as Easy as Planting Potatoes

Sir—To prevent any of your readers who are engaged in hydraulic or electrical engineering from getting exaggerated ideas of the difficulties of their work, an extract from an editorial in the Worcester *Telegram* of Dec. 19, 1917, is inclosed. In it the writer takes the popular way of "doing his bit" by giving advice to

the farmers of Maine, who apparently control the water-power of that state. The writer says:

"The mathematical problem is simple. Locating the sites on streams and lakes and building the dams are as simple matters as planting potatoes, and all this country is waiting for the electric power to use in place of millions of tons of coal for which we are paying individual miners $5000 a year for the digging. We are paying more for the imperfect power of coal than we should pay for the perfect power of the streams and lakes reduced to electric currents. And we fuss and worry about the coal. With the work well done in Maine we should have only to press the button and enjoy life without a worry."

While I realize that you have no space for a "joke column," I regret that the abundant supply of humorous matter furnished by the daily press when discussing technical matters cannot be utilized for its real value.

Worcester, Mass. A. L. HEYWOOD.

The Man with Something To Sell

Sir—In the article by Charles J. Bennett, "Hard-Surface Pavements for State Highways," *Engineering News-Record* of Nov. 22, p. 954, the author makes a statement which, from our point of view, deserves commendation and emphasis. It appears under the subheading of "The Man With Something to Sell," in which Mr. Bennett says that one of the requisites to be demanded in connection with pavement sales is "a broader-minded attitude on the part of the pavement salesman, coupled with the same honesty that is demanded of the highway engineer."

We recall an editorial in *Engineering Record* of Nov. 11, 1916, which was very much along this line. It was stated that some promoters of roads were proceeding on the theory, profitable temporarily perhaps, of "going while the going was good," but that their policy was shortsighted. Incidentally, the same thought was contained in a letter from this company sent out in May last, and addressed to engineers and the press, in which it was urged that both portland cement and asphalt be used in highway construction as Mr. Bennett has used them. The reason was set forth in the concluding paragraph of the letter, which was as follows:

"The element of self-interest in these suggestions is this: That we believe the highest success of any product is dependent upon its wisest—not necessarily its largest—use."

Without question, sincere coöperation on the part of engineers and manufacturers of road materials would be attended with better results than are now obtained.

D. T. PIERCE,
Executive Assistant, Barber Asphalt Paving Company.
Philadelphia, Penn.

Variations in Transit Needles

Sir—In a letter in your issue of Dec. 13, p. 1119, W. Newbrough asks for the experience of others in regard to the variation in transit needles. In the official survey of mining claims and other public lands it is now required that the true bearings of all lines be given, usually determined by solar observations, but the old rule that the variation of the needle at all corners be noted is still kept in force. In noting the variation for this purpose the writer has found that there is sometimes a difference in the results using different instruments. As a rule this difference is slight, but occasionally a needle is found which differs from the general run quite decidedly. One instrument used by the writer always shows a variation about 1° greater than that found by other instruments on the same work.

It is also found that in certain places the same needle will give differing results at different times. The best illustration of this coming under the writer's notice was as follows: The instrument was set up on a high rocky point and a true north line laid off, the needle being set at zero and left free. In a short time it was noticed that the needle was pointing about 30′ off, but there had been no change in the line of sight. The instrument was in this position for several hours, during which the needle varied several times. The day was partly cloudy, and it was found that the pointing of the needle varied with sunshine or shadow on the rocks, undoubtedly due to static electrical conditions.

There should always be a constant slight increase in variation as one goes north, but the writer found one district where there was a distinct jump of half a degree in crossing a strip a few hundred yards wide, while the variation remained the same for miles on each side of this point. These conditions are not caused by any constant local attraction. In work with modern methods they are only matters of academic interest. Occasionally in retracing old property lines originally laid out by compass surveys a study of such matters will be of practical assistance. A. M. STRONG,

Of Veuve & Strong, Consulting Engineers.
Los Angeles.

Easy Method of Computing Area of a Circle

Sir—The following method of computing the area of a circle may be generally known, but I have never seen it in print, and give it for what it may be worth:

Area of circle $= D^2 \times 0.7854$

If $D = 4$ $D^2 = 16$

	0.7
Multiplied by 0.7	11.2
Multiplied by 0.07	1.12
Multiplied by 0.014 = (0.007 × 2)	0.224
Multiplied by 0.0014	0.0224
0.7854	12.5664

The method is simple and easy and explains itself.

Greenville, Mass. B. B. GORDON.

Federal Aid Road Act in Full Force

According to a recent report from the U. S. Department of Agriculture, all the states of the Union have availed themselves of the opportunity of participating in the benefit of the Federal Aid Road Act. When it is realized that in 1916 only $41,000,000 of state funds were expended for highway purposes, and that in 1917 this figure had risen to at least $60,000,000, it can be readily seen that the passage of the act has done much to stimulate road construction. A number of the states have made specific appropriations to meet federal aid dollar for dollar, among these being New York, Illinois, Michigan, Rhode Island, Nevada, Iowa, Florida and Vermont.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Use Steel Pipe as Cement Shed on Dam Construction Job

STEEL pipe, 84 in. in diameter, is used to store cement at the dam being constructed on the Dead River, in Michigan, for the Cleveland-Cliffs Iron Co. The pipes for the flumes are 35 ft. long, and as each is unloaded it is blocked up, so that water cannot enter at

SEVEN-FOOT PIPE HOLDS 1000 SACKS OF CEMENT

the ends. The cement is unloaded directly from cars to pipes, and the ends of the latter are closed with boards or evergreen boughs. Each length will accommodate 1000 sacks. As the cement is continually being withdrawn for use, and as there are 10 to 15 lengths of pipe available, the contractor, The Foundation Co., is spared the expense of building storage sheds. L. C. Jacobs is superintendent on the work.

Find Cushion of Two-Inch Rope Best for Driving Concrete Piles

IN DRIVING a number of precast concrete piles at one of the yards of the Navy Department last fall a great deal of trouble was saved and faster driving secured by using a cushion of 2-in. manila rope. The piles, which were 30 ft. long and 12 x 12 in. in section, reinforced with a ¾-in. rod at each corner, were driven with a No. 1 Union hammer. The inelastic piles and the quick-striking, double-action hammer did not make a good combination, damage being done to the piles and the hammer, and delays resulted from both causes.

A large quantity of worn 2-in. manila hawser was available at the yard, and it was easy therefore to employ this material for cushions. These were made by simply coiling old pieces of rope until a circle large enough to cover the pile head had been made. Although each cushion has to be thrown away after its first use, one man was able to make sixty of them in a few hours. As, under the conditions, the driver had a capacity of about twenty piles a day, this was sufficient for three days' work.

The method was resorted to after it had been found impracticable to use a follower and wood-cushion blocks. It is stated that with the use of the rope cushions the penetration of the piles was increased and damage to the piles and hammer eliminated.

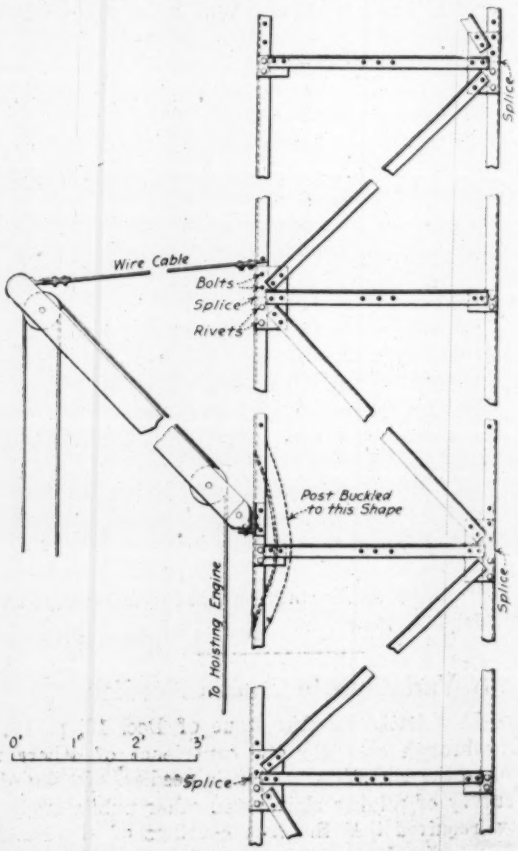
Replace Buckled Post Near Middle Without Taking Down Steel Tower

BY JOHN T. SULLIVAN

Civil Engineer, Roos Bros., Contractors, Cincinnati

WHILE lumber was being hoisted to one of the upper floors of the Industrial Arts Building of the new East Side High School in Cincinnati, the load began to spin, and the hoisting lines became crossed. A heavy strain was put on the boom, which buckled the corner post at which the boom was seated, as shown in the accompanying sketch. Although there was 132 ft. of steel tower above the buckled section, it was taken out and replaced without taking down the tower.

The bearing timbers were inserted underneath the second horizontal member above the boom seat and on top of the first horizontal member below it. A timber and a shoring jack were inserted to restore the tower to plumb and take the weight off the damaged section. The second panel part above the boom seat had to be



BUCKLED SECTION WAS REPLACED IN NINETY MINUTES

used as the upper support, since the gusset at the first panel point was riveted to the damaged section of the angle post and had to be removed with it.

After slight strain had been taken on the jack the bolts in the damaged section were easily loosened and the section was removed. The jack was then tightened and the corner raised to its original level, after which the new section was inserted and bolted.

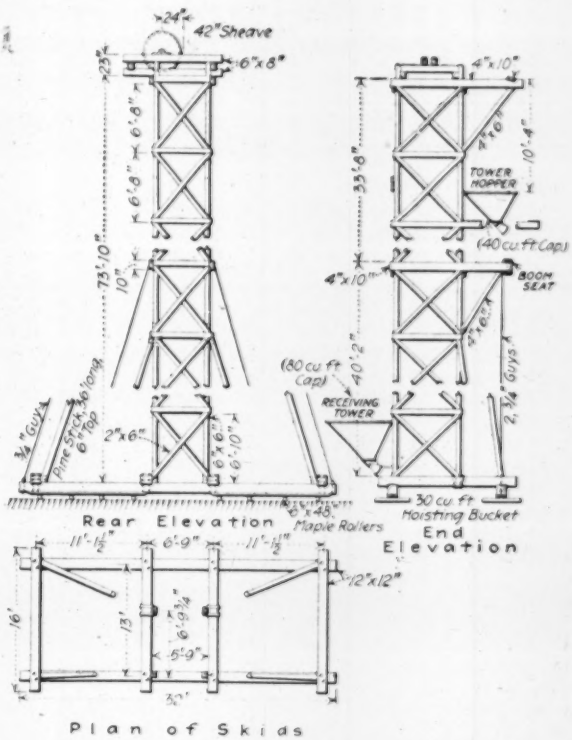
The entire repair had been completed within 1½ hours after the accident. In the opinion of the writer the small amount of trouble and delay occasioned was due to the fact that the accident occurred with a steel tower. Had it happened with a wood tower the corner post might have snapped off and caused the collapse of the entire upper part of the structure.

Traveling Concrete Tower Flanked by Two Derricks Builds Spillway

By L. G. Arnold
Formerly Assistant Superintendent, Wissota Dam

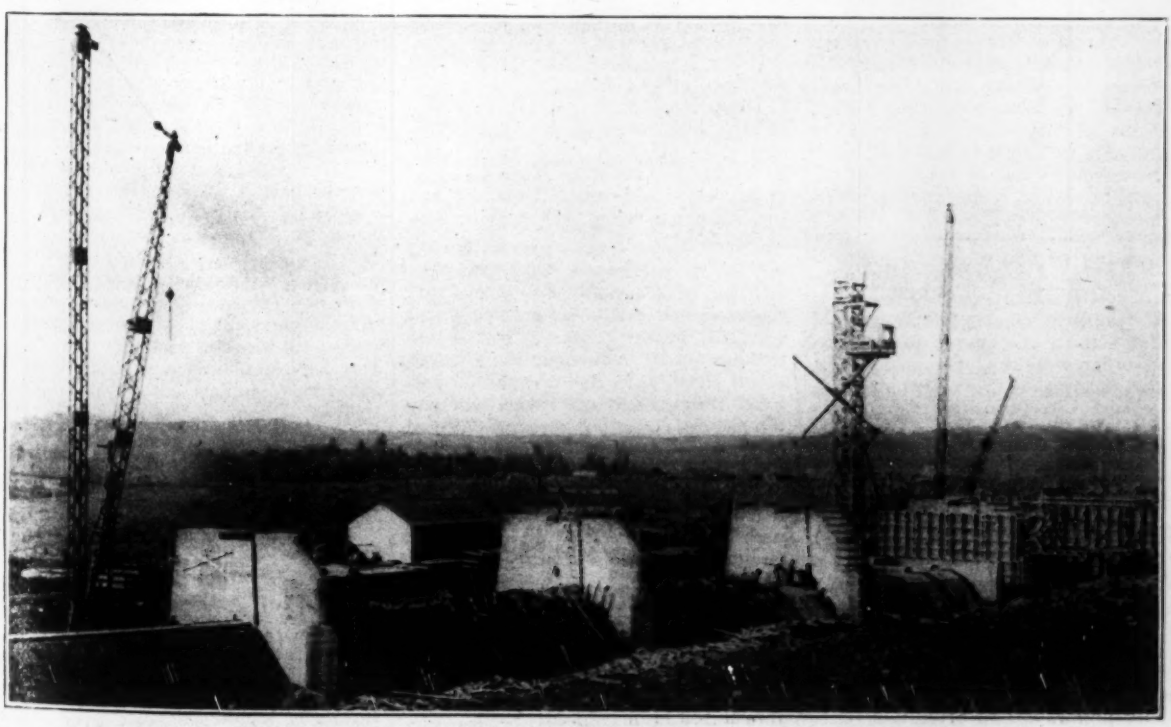
IN CONCRETING the spillway of the Wissota Dam the movable tower shown in the drawing and photograph worked between two large guy derricks which set up and stripped forms for the various buttresses and decks, shifted the chutes for the concrete plant and pulled it forward or backward as required. The concrete tower and the derricks themselves were moved on a track on short trestle bents of standard construction.

Concrete was carried to the plant in two 5-yd. electric concrete cars from the central concrete plant. These cars operated on a standard-gage third-rail electric railway which crossed both channels of the river. Concrete was dumped from them into the receiving hopper and hoisted in a 30-cu.ft. bucket. The tower had a radius of operation of 150 feet.



TOWER WAS PULLED ALONG BY DERRICKS

It was quite common with this method to average 300 yd. of concrete a day. Approximately 12,000 yd. was handled with this plant between Oct. 10 and Nov. 17, at a remarkably low unit cost. The Wissota Dam, located near Chippewa Falls, Wis., was built by the Wisconsin-Minnesota Light & Power Company.



PAIR OF DERRICKS, ONE ON EACH SIDE, HANDLED FORMS FOR MOVABLE SPOUTING PLANT

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Estimating the Cost of the Proposed Imperial-Laguna Dam Connection

After the announcement that the Secretary of the Interior had granted permission for the construction of a canal to supply the Imperial Valley system from the Laguna Dam. C. K. Clarke, chief engineer of the district, was authorized to prepare an estimate of the work involved in making such connection. In the brief time allotted for the preparation of these first estimates, it was impossible to compile final or detailed figures. However, certain data were collected and have been filed with the directors in the shape of a preliminary report. The report is based on a connecting canal 17 miles in length, part of which would be the U. S. Reclamation Service canal from Laguna Dam to Siphon Drop (enlarged to 10,500 sec.-ft. capacity) and the remainder a newly constructed canal with a capacity of 8000 second-feet.

The excavation required for such a connection, Mr. Clarke estimates, would total approximately 7,187,200 cu.yd. Increasing the capacity of the Reclamation Service canal would involve the handling of 1,586,000 cu.yd. of earth, 2,267,000 cu.yd. of hardpan and 656,800 cu.yd. of rock. The new canal construction would require the removal of about 898,800 cu.yd. of earth and 1,758,000 cu.yd. of hardpan.

In addition to the excavation there would of course also be necessary alterations to the dam, including headworks and provision for settling basins. The preliminary report prepared by Mr. Clarke is limited to the canal work and does not include an estimate of the amount or cost of reconstruction at the dam.

Buffalo Water-Waste Survey Ordered by Council

A complete water-waste survey of Buffalo, N. Y., at a cost of $44,000, has been ordered by the city council. A partial survey by the Pitometer Co., New York City, indicated that by covering the whole city an expenditure of $80,000 in coal and $40,000 in wages could be saved.

Floods Cause Trouble in Seattle

Floods and washouts at and near Seattle caused serious interruption to traffic for a period beginning Dec. 27. On Jan. 9 railway traffic officials reported that considerable time must elapse before normal service could be established. Much damage was done to county highways and bridges.

Garbage of Three More Cities To Be Fed to Hogs

Under a three-year contract awarded about Jan. 15 to the Reservoir Heights Stock Ranch, Inc., all the garbage collected by the City of Minneapolis will be fed to hogs. The city will receive $1.26 per ton for the garbage delivered at a central loading station instead of having to haul it to the city refuse incinerator and burn it, as has been done for a number of years past. The garbage will be weighed by the city weigher.

The garbage-collection tanks will be placed by the city f.o.b. cars at the Soo Line Railway tracks at the central loading station, or else on contractors' wagons at the same point. The contractor must remove all garbage within 12 hours from the time of its delivery to him by the city. The collection tanks are to be cleansed and returned undamaged to the central loading station on the day following their removal from that point. The contractor must keep in a sanitary condition the central loading station, and also the routes along which the collected garbage is hauled.

The contract includes all market garbage and refuse (excepting feathers) and includes the paper in which the garbage of Minneapolis has been wrapped by householders for some years past, together with various household wastes that must be expected in wrapped garbage.

Under two earlier calls for bids the city was offered first $1.16 and then $1.25 a ton. The contract specifications, which were drawn some time ago, stated that in 1916 the city collected 24,000 tons of garbage, the minimum being 1462 tons in February and the maximum being 2933 tons in September.

After considerable discussion and the reception of bids for a 10-year contract for garbage disposal by feeding to hogs or by reduction, the City of South Bend, Ind., has accepted a proposal from a contractor who will pay the city $1 a ton for garbage collected and delivered to the city incinerator, which has a very central location. The decision in favor of disposal by feeding to hogs was reached in accord with a recommendation by Samuel A. Greeley, consulting sanitary engineer, Chicago.

Harrisburg, Penn., has let a 63-month contract for garbage collection and disposal at $2000 per month. The garbage will be fed to hogs. Heretofore it has been reduced.

Engineers of Tests and Draftsmen Wanted for Ordnance Department

Among the several thousand civilian workers needed urgently for the ordnance department of the Army, the U. S. Civil Service Commission announces, are 200 engineers of tests of ordnance material, from $1500 to $2400 a year; 200 assistant engineers of such test, from $1000 to $1500 a year; 500 mechanical draftsmen, from $800 to $1800 a year, and 50 gage designers, from $2000 to $3000 a year.

The salaries named are the usual salaries at entrance. Higher or lower initial salaries may be paid in exceptional cases. Further information may be obtained from the representative of the Civil Service Commission at the post-office or custom house in any city, or from the Commission in Washington.

Charter Granted to New York Chapter, American Association of Engineers

The New York Chapter of the American Association of Engineers was established on Wednesday evening, Jan. 16, at the Hotel McAlpin, when the charter granted by the national organization was formally presented by President Edmund T. Perkins. The keynote of the meeting was sounded by Mr. Perkins, the principal speaker, with the subject, "The Engineer's Relation to Society." He urged the men to broaden their social and civic activities and to pay more attention to the human equation in engineering. Alexander Potter complimented the association on its national success with the problems relating to the human and business side of the engineering profession. A. H. Krom, general secretary of the A. A. E., gave a summary of the activities of the national organization and urged the members to promote the work and coöperate with all technical societies as well as to acquaint engineers with the fact that this is a business organization in a field of its own and which conflicts with none. E. J. Mehren, editor of *Engineering News-Record;* S. J. Stone, A. C. Davis and others put forward valuable suggestions during the discussion. The New York office is at 220 West 42nd St., and the officers are R. H. Vanderbrook, chairman, and I. L. Birne, secretary.

Education Association Meeting

The Vocational Education Association of the Middle West will hold its fourth annual convention in Chicago at the Morrison Hotel, Jan. 24-26. A wide variety of topics.

Concrete Institute Meeting Postponed

On account of the congestion in the railways, particularly the difficulty of travel to and from Chicago, the Board of Direction of the American Concrete Institute on Jan. 16 decided to postpone the annual convention of the Institute until June 24-26, 1918, at Atlantic City. The convention had already been arranged to be held in Chicago Feb. 7-9, and a program was off the press. This program, together with preprints of papers and committee reports, will be sent very soon to all members of the Institute in the hope that written discussion will be made available for presentation at the June meeting. By that time, it is expected that railway travel difficulties will have eased up considerably. Certainly they will not be subject to the present inconveniences due to weather. The meeting at Atlantic City is coincident with and just before the meeting of the American Society for Testing Materials, which has always been attended by a number of members of the American Concrete Institute.

Meeting of National Chamber of Commerce

The Chamber of Commerce of the United States of America will hold its sixth annual meeting Apr. 10-12, in Chicago.

The headquarters for the board of directors and committees will be located at the Congress Hotel. The sessions of the annual meeting will be held in the auditorium.

The Aldred Lectures on Engineering Practice

The first of the 1918 J. E. Aldred lectures on engineering practice at the Johns Hopkins University, department of engineering, Baltimore, Md., was delivered on Wednesday, Jan. 16. The remaining lectures of the course will be delivered on Wednesday evenings until Mar. 20. There will be none on Feb. 6.

The course of lectures is one feature of a general plan, made possible by Mr. Aldred's gift, for furthering and improving undergraduate instruction in the methods and problems of the practice of engineering. The lectures will deal, therefore, with the practical phases of engineering problems, rather than with theory. They are not expected to discuss new and striking applications as much as to deal with everyday working methods of design, construction and operation.

Since the lectures are planned espe cially for undergraduate students, they will presuppose an elementary rather than an extensive knowledge of underlying theory, and will lay special stress on the tangible and obvious fea tures and principles of practical engineering of the present day.

Maj. Gen. William M. Black, chief of engineers, U. S. Army, will deliver the Jan. 30 lecture. His subject will be "The Relation Between Civil Engineering and Military Engineering." On Feb. 13 Arthur N. Johnson, consulting highway engineer, Portland Cement Association, Chicago, will lecture on "The Development of Concrete Road Construction." The lecture of Mar. 20 will be on "The Control of Stream Pollution," and the speaker will be Earle B. Phelps, Hygienic Laboratory, American Public Health Service, Washington.

The remaining six lectures of the present course are devoted to topics that interest the chemical and mechanical engineer rather than the civil engineer.

Early Settlement of Chicago Drainage Canal Suit Possible

By a unanimous vote the trustees of the Sanitary District of Chicago have offered to contribute $475,000 to the Federal Government for weirs to maintain the levels of the Great Lakes. To become effective the offer must be approved by Congress. The proposition is based on the condition that its acceptance will terminate the controversy over the amount of water to be withdrawn from Lake Michigan and will concede the district's "right to withdraw water as required by the Illinois statutes to the ultimate maximum amount of 12,000 cu.ft. per second."

Of the amount offered $150,000 would be required to build submerged weirs, 4.2 ft. high, in the Niagara River near Squaw Island, and the remainder for submerged weirs, 5 to 6 ft. high, in the St. Clair River three miles below the mouth of Black River at Port Huron. The proposition is in accordance with recommendations made Aug. 15, 1913, by a board of engineers for rivers and harbors headed by Gen. William M. Black, then colonel, Corps of Engineers, and now Chief of Engineers, U. S. Army. It was the opinion of the board that compensation by fixed contraction affords the cheapest and most satisfactory method of preserving the lake levels. The report recommended in substance that no objection be made to the further withdrawal of water from Lake Michigan at Chicago provided the necessary funds were placed at the disposal of the Secretary of War. A further recommendation was that Congress should fix definitely the total volume of water to be diverted beyond the existing diversion.

The proposal would seem to answer all reasonable objections from navigation and shipping interests, which have had little ground for complaint in recent years because the levels have been higher than for many years previous to the opening of the main drainage channel. As to the power interests at Niagara Falls, it is the opinion of competent attorneys that the diversions provided for in the treaty with Canada, which fixes the Canadian rights, to greater amounts than those of the United States, was evidence that the withdrawal at Chicago was taken into acount in drafting the treaty.

Construction Regiment of Engineers Now Being Recruited

There is now being formed at Camp Devens, Ayer, Mass., under the command of Col. Mark Brooke, Corps of Engineers, U. S. Army, a regiment of engineers for general construction work in France. For this unit all classes of skilled and unskilled labor are required. Among the different kinds of workmen desired are bridge, house and form carpenters, structural steel men, reinforcing steel setters, engineers, firemen, mechanics, machinists, steamfitters, blacksmiths, miners, riggers, derrick men, piledriver operators, concrete laborers, construction superintendents and foremen, civil and mechanical engineers, clerks, stenographers, timekeepers, paymasters, storekeepers and supplymen—in fact, every kind of worker usually engaged on construction jobs.

Men of special qualifications will be given noncommissioned rank up to the senior grade of master engineer. As soon as the regiment is filled and the equipment shipped, the men will leave for France. Men of draft age may join by applying to headquarters, 33rd Engineers, Camp Devens, Ayer, Mass., by mail, stating age, address, occupation, draft status and number, and number of local board, signifying their desire to volunteer for immediate service in the regiment. Men not in the draft, between 31 and 41, may enlist at the nearest army recruiting station, specifying their enlisting for service in the 33rd Engineers. It is entirely a volunteer regiment.

Consumers Must Install Water Meters at Cincinnati

Acting under a plan officially adopted last December, which provides that all water must be supplied through meters by Jan. 1, 1920, Cincinnati, Ohio, has been divided into six districts and the consumers in the first district are now receiving instructions to have meters installed before July 1, 1918. It appears that the full adoption of the plan is to be hastened, since it is reported that orders will be sent to the other five districts requiring the installation of meters before the first of August, 1918, and so on until the whole city is covered before Dec. 1 of the present year. Altogether about 18,000 consumers are said to be affected. Charles S. Hornberger is director of public service of Cincinnati and J. A. Hiller is general superintendent of water-works. A 25% increase in both meter and flat rates went into effect in Cincinnati on Jan. 1.

Wood Pipe Laid in Alkali Soil

Experiences with wood pipe laid in alkali soil are desired by J. W. Wisda, city engineer, Rawlins, Wyo., who states that the use of such pipe for a gravity water-supply is under consideration by his city.

Orders Issued Reorganizing the Alaska Road Commission

Brig. Gen. W. P. Richardson, National Army, was recently relieved from further duty with the Board of Road Commissioners for Alaska, and First Lieut. Sidney L. Carter, of the Engineer Reserve Corps, was assigned to active duty, effective Dec. 26, 1917. The latter was detailed for duty as a member of the Board of Road Commissioners for Alaska and as secretary and disbursing officer of the Board, relieving Capt. John Zug, Engineer Reserve Corps, of this duty. Captain Zug, in addition to his other duties, will aid in the supervision of the work of construction in the field as assistant engineer officer of the Board of Road Commissioners for Alaska.

Capt. William H. Waugh, Engineer Reserve Corps, in addition to his duties as engineer officer of the Board of Road Commissioners for Alaska, will serve as president thereof, discharging the duties of that office as prescribed in the orders of the War Department of Feb. 15, 1913.

These orders will govern the operations of the board, except that all correspondence and business from the board to the War Department will be submitted to the Chief of Engineers of the Army, who will exercise general supervision of the work of the board.

Federal Civil Service Examinations

The U. S. Civil Service Commission has announced open competitive examinations for the following positions: Copyist, topographic draftsmen, Geological Survey, for which examination application may be made at any time; apprentice draftsman and photographer, application to be made at the Bureau of Mines, Washington, by Feb. 6. Full information and application blanks may be obtained by addressing the U. S. Civil Service Commission at Washington, or the Civil Service District Secretary at Boston, New York, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, St. Louis, New Orleans, Seattle or San Francisco.

Rapid-Transit Studies Begun in Cleveland

The first session of Cleveland's new rapid-transit commission was held recently. C. A. Otis is chairman, and Street Railway Commissioner Sanders is a member. The work of drawing up plans has already been started in the office of City Engineer Hoffmann.

Engineer Gets Twenty-Year Contract—Without Pay

The City Commission of Trenton, N. J., recently adopted a resolution in accordance with an agreement between it and the Public Service Railway Co. designed to safeguard the underground pipes of the city from electrolysis. The company has agreed to install and maintain "an electrolytic mitigation system under the direction, supervision and control of E. E. Brownell, consulting electrical engineer, as the representative of the city," with the understanding that Mr. Brownell is to be engaged by the city for a term of twenty years "without cost to the city."

Los Angeles County Flood-Control Bonds Validated

The decision of the California State Supreme Court validating the Los Angeles County flood-control bonds has been announced. Pending the announcement of the court in this matter, the county flood control engineers have not commenced any actual construction and the activities of the engineering department have been limited to surveys, plans and specifications and estimates. It has been stated, however, that work would be commenced as soon as a favorable decision was announced. In addition to the $4,450,000 in bonds voted by the county, there is also an appropriation of over $1,080,000 by the Federal Government and a like amount from the state, bringing the total funds released by this court decision up to $6,610,000.

Government Needs Ship Draftsmen

The Federal Civil Service Commission is urging heads of colleges and technical schools to give intensive training in naval architecture during the coming spring to senior students, and also urges qualified architectural, mechanical and structural steel draftsmen to enter the Government service as ship draftsmen. There is a dearth of ship draftsmen, the commission asserts, to carry out the Government's shipbuilding programs.

Voted To Pay for San Francisco Refuse Destructor

Upon the recommendation of the city attorney of San Francisco, the Board of Supervisors of the city voted unanimously on Jan. 7 to pay the judgment of $185,650 against the city secured some time ago by the Destructor Co. of New York City, in a suit brought to compel the city to pay for the destructor which the company had built for San Francisco. The destructor has remained unused in the hands of the contractor.

A. R. E. A. Men in Military Service Exempted from Dues

The American Railway Engineering Association is included among the technical societies that have exempted from dues for the duration of the war all members while in actual military service. The board of direction so voted Nov. 23, 1917. Such members will retain all the privileges of the association and will receive its publications upon application when they return from their military duties.

Michigan To Have Short Course in Highway Engineering

Following the general plan of the past three years, the University of Michigan announces that its fourth short course in highway engineering will be given at the university in Ann Arbor during the week of Feb. 25 to Mar. 1. The course will be a continuation of work done in the past three years, but it will be so arranged that those coming for the first time will not be seriously handicapped. The instruction will be given from the viewpoint of road conditions in Michigan for the special benefit of highway commissioners, highway engineers, contractors and others interested in the construction and maintenance of roads. One day will be set aside for the discussion of the effect of the war on road construction and maintenance, and in addition the subject of finance will be taken up, and discussions of the policy to be pursued in the administration of roads particularly during the war will be encouraged.

The instruction will be under the supervision of the engineering faculty and men in the employ of the Michigan State Highway Department. Supplementing these will be lectures by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, City of New York; A. D. Williams, chairman of the West Virginia State Highway Commission; John H. Mullen, engineer of roads for the Minnesota State Highway Commission; C. J. Bennett, state highway commissioner of Connecticut; R. D. Chapin, chairman of the Highways Transport Committee of the Council of National Defense, and Frank F. Rogers, state highway commissioner of Michigan. No charge is made for the course, which will be open without examination to anyone interested.

Better Health Protection for Chattanooga

In line with the efforts of Federal health authorities to improve health conditions in the vicinity of army camps, Dr. C. P. Knight has recommended an appropriation of $25,000 a year for health-protective work in Chattanooga. The recommendation includes a full-time health officer, who must be a graduate in medicine with three years' experience in health work, with a salary not to exceed $3000, and four sanitary inspectors at $100 a month each. The mayor of Chattanooga and the Chamber of Commerce are said to regard the appropriation with favor.

First Project Manager Appointed by Water Users

In a "Personal" note *Engineering News-Record* of Dec. 20, p. 1178, said that W. R. Elliott "is the first project manager to be appointed by the water users themselves on any project in the

United States." This is an error; the first project manager appointed by the water users of a project built by the Reclamation Service is A. B. Brown, manager of the North Side gravity unit of the Minidoka project. Also, Mr. Elliott was not formerly a supervising engineer in the Reclamation Service, as stated, but an electrical assistant on the Salt River Project.

Michigan Has $4,000,000 for Road Construction in 1918

During the year 1918 there will be available over $4,000,000 for highway improvements in the various counties of Michigan. This amount will be raised entirely by the counties in the form of taxes. In addition to this there is available a state-reward and automobile-tax fund which amounts to nearly $2,000,000, and the Federal-aid fund, amounting approximately to $500,000.

Providing that railroad cars are available, many important links in the trunk-line highway system of the state will be filled in. However, if railroad equipment cannot be assigned to highway work, it is the intention of the Highway Department to go ahead with the work as far as it is possible to do so by the use of auto trucks and available local material. Several of the routes are being rushed on account of their military importance. One, between Detroit and Monroe, on the Toledo road, is a very important connection between Detroit and the East, and will carry much freight between this point and the seaboard.

Waterfront at Corpus Christi, Texas, To Be Improved

A bond issue of $600,000 for waterfront improvements has been carried at Corpus Christi, Tex., by a vote of 395 to 9. Final plans have not been adopted, but the general scheme is to construct a short protection or seawall which will secure the city against damage from wind and wave action. Incidentally, this improvement will furnish lagoons and harbors for small craft, and also give an opportunity for development of the bay front with drives and parks. When the work will be commenced is uncertain, and it may be several months before the city is ready to advertise for bids. The condition of the bond market, the state of the labor supply and the difficulty of obtaining material are all unfavorable to an early start. The general plans have been prepared by Hubert A. Stevens, city engineer.

Buffalo May Build Municipal Hydro-Electric Plant

An appropriation of $10,000 for employing an engineer to select a site and prepare plans for a municipally-owned or controlled hydro-electric plant has been made by the city council or commission of Buffalo, N. Y., at the request of Commissioner Heald.

Purdue University Offers Special Course in Roads

An announcement has been issued that the department of highway engineering at Purdue University will offer a short course of illustrated lectures, laboratory observation and conferences upon general road subjects, for three days, from Jan. 29 to Jan. 31. The State Highway Commission will be in attendance and has offered to cooperate in every way to promote the interests of the schoool. Furthermore, the State Council of Defense will be asked to attend and discuss Priority Order No. 2.

Request has been made upon the State Board of Accounts to pass upon the legality of the desire of the Highway Commission to allow time and carfare to every county highway superintendent while in attendance at this special school. While no definite decision has been rendered as yet upon this point, it is thought that the good results from previous schools of this sort held by Purdue University will insure a large attendance in any event.

Shipping Board Increases Its Housing Program

The U. S. Shipping Board has made several appropriations for additional housing facilities in shipyards, although the total amounts are very much lower than those asked for in the current appropriation bills before Congress. For workers at Newport News, Va., $1,200,000 has been assigned, but no announcement has been made as to the methods of administering the funds or the relation of the private yards there to the houses when completed. Additional appropriations have also been made for the Government yards, but amounts and details are not specified. In fact, while there is undoubtedly great activity in shipyard housing, the whole matter is surrounded with a secrecy characteristic of a good deal of the Shipping Board's work.

PERSONAL NOTES

H. T. MEHLER, until recently district engineer in the construction department of the Southern Ry. at Lexington, Ky., has been assigned to other duties and HORACE STRINGFELLOW, who has been assistant engineer in the same department, has been promoted to succeed him.

ROBERT L. FOX, formerly of Johnstown, Penn., is now City Engineer of Bethlehem, Pennsylvania.

HENRY W. TROELSCH, formerly of Bala, Penn., is now with the American Bridge Co., New York City.

WILBUR H. WINANS, who was until recently with R. WINTHROP PRATT, consulting engineer, Barberton, Ohio, is now with the valuation department of the Baltimore & Ohio R.R., at Cincinnati.

J. L. CUMMINGS, who is now acting bridge engineer of the Mobile & Ohio R.R. at Mobile, has been until recently engineer of the St. Louis division of the same road.

MAJ. C. J. TAYLOR, until recently assistant to District Engineer COL. HEUER, San Francisco, Calif., has been appointed Western Department Engineer by the War Department to succeed LIEUT. COL. RICHARD PARK.

C. LOUIS ZULL recently resigned his position with the Foundation Co., on its work in Cincinnati, to become connected with the Miami Conservancy District, Dayton, Ohio.

JAMES M. HOMER has been appointed water commissioner of the city of Olean, New York, and GEORGE H. LUTHER has been made commissioner of public works of the same city.

WILLIAM E. WALSH has been appointed superintendent of the bureau of buildings, Borough of Manhattan, New York City. He succeeds ALFRED LUDWIG. Mr. Walsh has been a building constructor in New York City for the past 21 years.

B. H. WAIT has been appointed district engineer for the Portland Cement Association at New York City. Mr. Wait is a graduate of Cornell University, 1902, and has been engaged for a number of years in highway work in New York State. More recently he has been division engineer with headquarters at Poughkeepsie.

W. F. McDADE has resigned as division engineer of the Southern Ry., in Mississippi, with headquarters at Columbus, and has been succeeded by C. U. IRVINE.

DAVID A. DECKER has severed his connection with GILBERT C. WHITE, consulting engineer at Durham, N. C., to become assistant city engineer of Norfolk, Va. Mr. Decker served in a similar position for six years prior to March of last year, when he resigned to become associated with Mr. White, but was recalled by the City of Norfolk to take charge of additional water-supply developments.

W. E. BURKHALTER has been appointed acting division engineer of the St. Louis Division of the Mobile & Ohio R.R., with headquarters at Murphysboro, Illinois.

T. HOWARD BARNES has resigned as consulting engineer for the United Fruit Co. and that office has been abolished. During the past 12 years Mr. Barnes has designed and conducted the construction of many of the important works of the company. He has collaborated in the design of sanitary municipal improvements for the republics of Panama, Costa Rica and Guatemala, and is well known in most of the Central American republics and in Cuba. He will remain in practice as consulting engineer.

FRANK C. WARNER has been appointed U. S. district engineer for the Wilmington, Del., engineering district, in succession to LIEUT. COL. MARK BROOKE, Corps of Engineers, U. S. Army, who has been transferred to the National Army and placed in command of the 330th Regiment of Engineers, at Camp Devens, Ayer, Massachusetts.

R. E. CHANDLER, professor in the mechanical engineering department of the University of Florida, has been elected president of the Florida Engineering Society, to serve for the ensuing year.

MELVILLE DOZIER, JR., consulting and executive engineer, of San Francisco, has been appointed general manager of the California State Reclamation Board. The appointment was made at a meeting of the board in Sacramento, on Jan. 4. This position was created by the last legislature, but was unfilled until Mr. Dozier's appointment. He was formerly assistant general manager of the Northern Electric Ry. Company.

W. A. GROVE has resigned as plant civil engineer to the B. F. Goodrich Co., Akron, Ohio, to become Chicago manager for Gardner Williams consulting engineer, Chicago.

FORD, BACON & DAVIS, engineers, New York, announce the formation of the FORD, BACON & DAVIS CORPORATION, organized for the purpose of conducting a general contracting business, with particular reference to industrial, public utility and power plants, steam and street railroads. The corporation announces that in effect this means the continuance in corporate form of the construction work which heretofore has been handled by the firm direct.

C. H. PURCELL, chief bridge engineer for the Oregon State Highway Department, has resigned to accept a position with the Government as bridge engineer under L. C. HEWES, district bridge engineer, with headquarters at Portland, Oregon.

LAMAR COBB, former state engineer of Arizona, has been reappointed by Governor Hunt to succeed THOMAS MADDOCK, who recently resigned.

HORACE H. HULL has been elected city engineer of Memphis, Tenn., to succeed J. H. WEATHERFORD, who has resigned to engage in consulting practice in Memphis.

M. G. LONGWELL, resident engineer of the Union Railway Co., Memphis, Tenn., has accepted the position as engineer maintenance-of-way, Wabash R.R., at Montpelier, Ohio.

WILLIAM J. HENRY, JR., formerly highway engineer, New York State Highway Department and Barge Canal Office, Albany, N. Y., has been commissioned a lieutenant in the Aviation Section Signal Corps and is now at the Aviation Camp, Morrison, Virginia.

OTIS L. MCINTYRE, who was with the U. S. Reclamation Service as assistant engineer for a number of years and more recently has been superintendent of the El Paso Foundry and Machine Co., El Paso, Tex., expects to leave El Paso shortly and become connected with the Cerro de Pasco La Fundicion, Peru, as superintendent of machinery.

K. G. WILLIAMS, assistant engineer, Rock Island Ry., at Memphis, Tenn., has been appointed resident engineer, Union Ry., at Memphis. He will continue to serve as engineer for the Rock Island Ry., the Arkansas & Memphis Railway Bridge and Terminal Co., and the American Bauxite Company.

HERBERT STANLEY BEAR, Columbus, Ohio, HUGO CARL FISCHER, New Bedford, Ohio, and GEORGE W. HORSLY, Cleveland, Ohio, have been appointed assistant civil engineers in the Navy.

HORACE G. BYERS, professor of chemistry at the University of Washington, is now a captain in the 30th Engineers, popularly known as the "gas and flame regiment."

W. G. PETERS has been appointed city engineer, superintendent of water, and building and plumbing inspector of Chehalis, Washington.

FRANK D. GORE, county engineer of Kitsap County, at Port Orchard, Wash., has enlisted in the Aviation Corps. He qualified as a flyer at San Diego, California.

EUGENE B. FULTON, of the Texas Construction Co., architects and engineers, San Antonio, Tex., is now a sergeant in the 23d Regiment of Engineers (Highway Regiment).

RUDOLPH WELCKER has given up his practice at Springfield, Mass., to become resident supervising engineer of the U. S. Navy, Department of Yards and Docks, in charge of the construction of ordnance and shipbuilding plants for the district of Baltimore.

FRANK H. MCGRAW has been appointed general superintendent of construction of Westinghouse Church Kerr, New York. Mr. McGraw has been with the organization for 14 years and has been in charge of the Westinghouse Electric job at Essington since construction commenced. Previously he handled a great deal of heavy construction, including the Communipaw locomotive terminal of the Central R.R. of New Jersey, the West Springfield shops of the Boston & Albany R.R., the Hotel Nassau, the Pittsburgh Terminal Co., and other large projects. Mr. McGraw will retain active charge of the Essington job until it is complete.

HERBERT W. BRADLEY, president of the Newton A. K. Bugbee Co., Inc., engineers and contractors, Trenton, N. J., has been commissioned by Governor Edge a captain in the Ordnance Department of the New Jersey State Militia and is now a member of the staff of Quartermaster General Murray.

EDWARD STUART, who went to Servia in 1915 as sanitary engineer of the American Red Cross Sanitary Commission, and was later appointed director of the Commission, has gone to Guatemala as sanitary engineer for the American Red Cross, to assist in preventing the spread of epidemics in the region of the recent disaster.

GEORGE N. HATFIELD, formerly road engineer of St. John, N. B., has been appointed to the vacancy created by the death of William Murdoch, city engineer of St. John.

JOHN F. COLEMAN, consulting engineer, New Orleans, La., has become chief engineer for the shipyards being constructed by the Tennessee Coal and Iron Co., at Mobile. His first task will be the construction of a village to house 5000 workmen.

MAJ. WILLIAM A. STARRETT, Engineer Reserve Corps, has been assigned to duty as contracting officer for the War Industries Board, United States Food Administration and the Ordnance Department.

LIEUTENANT COLONELS M. C. TYLER and W. H. ROSE, Corps of Engineers, U. S. Army, have been promoted to the rank of colonel and MAJORS F. C. HARRINGTON, W. H. SAGE, JR., and E. H. MARKS have become lieutenant colonels.

LIEUT. COL. R. R. RAYMOND, Corps of Engineers, U. S. Army, has been assigned to command the 3rd Engineers, on arrival in Honolulu, relieving COL. T. H. REES, who has been made a brigadier general.

E. C. WHITE, formerly in charge of the department of civil engineering at the New Mexico School of Mines, Socorro, N. M., is now Captain White, Engineer Officers' Reserve Corps, and is attached to the constructing quartermaster's department, Camp Beauregard, Alexandria, Louisiana.

C. A. HASKINS, engineer water and sewage division, Kansas State Board of Health, was commissioned captain in the Sanitary Corps, National Army, and ordered to Fort Oglethorpe, Ga., for training.

JOHN J. MANNING, until recently assistant engineer, Harbor and Dock Commission, Troy, N. Y., has been commissioned assistant civil engineer, U. S. N., with rank of lieutenant, junior grade, and has been ordered to Annapolis for temporary duty.

W. L. SWARTWOUT, formerly with the Harbor and Dock Commission, Troy, N. Y., is now assistant engineer with the American International Shipbuilding Corporation, Philadelphia.

INDUSTRIAL NEWS AND COMMENT

ABOUT MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Industry Halts at the Government's Command

List of Exemptions Omits Many Plants Engaged on War Work, but Compliance Is Prompt and Cheerful

Like an army, at the call of the commander, American industry in the vast territory east of the Mississippi River halted Friday in response to the five-day closing order of Fuel Administrator Garfield. Those plants engaged on work most urgently needed for the war remained in operation by special order of the Government. Few others kept working. Most closed without question and without urging that the Government give heed to the fact that they were engaged upon work that was essential to the progress of the war. In many of these cases no protest asking for exemption was made, although from 80% to 90% of the plant production was going to be used for military purposes.

The steel industries were as a rule instructed by the Government to continue in operation. Many of these were working upon munitions, ordnance or shipbuilding and work intimately identified with these branches. In consequence, many of the large plants in Pittsburgh, Philadelphia and the Great Lakes cities were operating as usual.

Nearly a Thousand Plants In The Exempted Industries

The exempted list numbered nearly a thousand plants in diverse lines of industry. Included among them were:

For the manufacture of important forgings:
Bethlehem Steel Company, South Bethlehem, Penn.
Midvale Steel Co., Nicetown, Penn.
Hydraulic Pressed Steel Co., Cleveland.
American Car and Foundry Co., Detroit.

For the manufacture of war essentials needed immediately:
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Burks Electric Co., Erie, Penn.
Electric Machinery Co., Minneapolis, Minn.
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Chicago.
Jeffrey Mfg. Co., Columbus.
Pittsburgh Transformer Co., Pittsburgh.
Reliance Electric & Engineering Co., Cleveland.
Triumph Elect. Co., Cincinnati.
Westinghouse Elec. & Mfg. Co., East Pittsburgh.

For the manufacture of forgings for destroyers:
Camden Forge Co., Camden, N. J.
Allis-Chalmers Co., Milwaukee, Wis.
Erie Forge Co., Erie, Penn.

For the manufacture of boilers for destroyers:
Babcock & Wilcox Co., Bayonne, N. J.

For the manufacture of seamless tubes less than 1¼ in. in diameter:
National Tube Co., McKeesport, Penn.
Pittsburgh Steel Tube Co., Pittsburgh.
Pittsburgh Steel Products Co., Pittsburgh.
Ohio Seamless Steel Tube Co., Shelby, Ohio.

For the manufacture of condenser tubes ⅝ in. in diameter for destroyers:
American Brass Co., Bridgeport, Conn.
Bridgeport Brass Co., Bridgeport, Conn.

For the manufacture of locomotive for the United States Government and American railroads:
American Locomotive Co. plants at Schenectady; Dunkirk, N. Y.; Pittsburgh, Penn.; Paterson, N. J.; Richmond, Va.; Manchester, N. H.
Baldwin Locomotive Works, Philadelphia; Eddystone, Penn. and Burnham, Penn.
Lima Locomotive Corp., Lima, Ohio.
H. K. Porter Locomotive Co., Pittsburgh.

For the manufacture of products for Shipping Board:
General Electric Co. plants at Erie, Penn.; Schenectady, N. Y.; and Lynn, Mass.

For emergency fleet orders and emergency Government work:
Bethlehem Steel Co., plants at Steelton, Penn.; S. Bethlehem, Penn.; and Sparrows Point, Md.
Midvale Steel & Ordnance Co., plants at Nicetown, Penn.; Coatesville, Penn.; and Johnstown, Penn.
Lukens Steel Co., Coatesville, Penn.
Carnegie Steel Co., Pittsburgh.
Crucible Steel Co., Pittsburgh, and Harrison, N. J.
La Belle Iron Works, Steubenville, Ohio.
Otis Steel Co., Cleveland.
Lackawanna Steel Co., Buffalo.
Illinois Steel Co., Chicago.
Jones & Laughlin Steel Co., Pittsburgh.
Donner Steel Co., Buffalo.
Inland Steel Co., Indiana Harbor, Ind.
Central Steel & Iron Co., Harrisburg, Penn.
Republic Iron & Steel Co., Youngstown, Ohio.
Brier Hill Steel Co., Youngstown, Ohio.
Corrigan, McKinney & Co., Cleveland.
Forged Steel Wheel Co., Butler, Penn.
Whittaker-Glassner Co., Portsmouth, Ohio.
Youngstown Sheet & Tube Co., Youngstown, Ohio.
Alan Wood Iron & Steel Co., Conshohocken, Penn.

Among the 42 plants exempted from shutdown on account of being engaged in making aircraft and signal corps products were included:

American Steel and Wire Co., Trenton, N. J.;
Bausch & Lomb Optical Co., Rochester, N. Y.;
John A. Roebling Sons Co., Trenton, N. J.;
Western Electric Co., New York City.

They Closed Cheerfully

Inquiry among the industries serving the construction and engineering fields showed that many of them were closed in spite of the fact that they were serving the Government or the contractors on Government construction. It was evident, also, that compliance with the Government order had been cheerful and prompt. Replies of many of the manufacturers to the query regarding the effect of the closing order upon their industries showed a patriotic inclination to serve the Government's needs in any way ordered by the war administration. Here are the comments of some representative industries in response to inquiries made by *Engineering News-Record* in the New York territory:

Joseph Dixon Crucible Co., Jersey City; crucibles and graphite lubricants; J. H. Schermerhorn, vice president, said:

"Our plant closed Thursday night as ordered. We laid off from 1400 to 1600 employees. We are short of finished stock. We have Government contracts in our various departments for crucibles, lubricants for tractors, boiler graphite and other products. Practically all of our products are being used by some Government department.

"Since the war started the Government has come first with us in everything. We have given it preference over any other business. But we are not making application for special privilege to continue operation. We feel that it is our duty to obey the Government order without question."

Davis-Bournonville Co., Jersey City, City, N. J.; oxyacetylene cutting and welding apparatus; S. W. Worthan, general manager, said:

"Both our plants are closed. The Jersey City plant employs 400 men and the Elkhart, Ind., plant has 200. At the present time 80% of our work is 'war' production, either direct for the Government or for the industries engaged on war work. We have not protested or asked for exemption. We regard it as our patriotic duty to close. We feel that every loyal citizen should support the Government in prompt action when demanded. We have made careful inquiry in this manufacturing district and find that our attitude represents the general feeling of manufacturers in this section."

Lidgerwood Manufacturing Co., New York; excavating and conveying machinery; H. N. Covell, works manager of the Brooklyn plant, said:

"Our work is 100% Government work. We have simply shut down both plants at Newark and Brooklyn for the entire five-day period, and will take the matter up for discussion with the Government later, if necessary."

Ransome Concrete Machinery Co., Dunellen, N. J.; Lawrence W. Brown, sales manager, said:

"If the closing down of the industrial plants is doing any good we are glad to be contributing our share. We employ 200 men, and though they suffer from the shutdown, there was remarkably little grumbling among them."

C. R. Crouch, superintendent for the Ransome company at Dunellen, added:

"Ninety per cent. of our business is Government work, either direct or to contractors on Government jobs. We are under contract to make time deliveries on a good portion of these orders. Regardless of this we closed Thursday and will stay closed until Wednesday."

Oxweld Company, Newark and Chicago, makers of oxyacetylene cutting and welding equipment, said:

"We shut down both plants Friday and Saturday on announcement of the

Fuel Administrator's order. Late Saturday afternoon we received word from Washington that we were exempted both for the five-day period and the succeeding Monday shutdowns.

"The Newark plant uses 1000 men and the Chicago plant 1600 men. So far as we know practicaly all of these are back at work this morning."

ORDER WAS OBEYED

Word received by the *Engineering News-Record* by telegraph from many industrial centers indicated that the closing order had been generally observed. Some manufacturers announced that they had been added to the exempted list, some of these exemptions having been made after the official list was handed to the press.

In the Pittsburgh district, the *Engineering News-Record* correspondent wired, the order was received without complaint. Most of the industries in the big steel center were allowed to proceed as usual, as they are working either directly or indirectly on war materials. Carnegie, Crucible Steel, Jones & Laughlin, Pittsburgh Steel Products, National Tube, Pittsburgh Steel Tube and Westinghouse Electric all continued in operation.

Blast furnaces were kept going. They have been the "thin neck of the bottle" in Pittsburgh's output recently and the partial shutdown gave them an opportunity to meet the demands of the steel mills.

Boston, Mass.—Our plant is engaged exclusively in fabricating steel work in connection with destroyer plant at Squantum, Mass. Feeling that we are exempt from the shutdown order we have notified the Fuel Administrator that we shall keep our shops running on this work unless notified by him to stop. (Signed)

THE BOSTON BRIDGE WORKS.

Beaver Falls, Penn.—We operate our own coal mine, hence the shutdown does not affect us.

(Signed) UNION DRAWN STEEL CO.

Chicago Closes War Industries Without Complaint

Patriotic Tone Dominates Response of Industrial Managers to Closing Order

BY W. W. DE BERARD,
Western Editor, *Engineering News-Record*

Chicago, Jan. 21.—Industries supplying the civil engineer with manufactured products in the Middle West are taking the fuel shutdown order philosophically and patriotically. The saving in coal in few cases will be commensurate with the lost production, but the industries are not complaining, as they feel that Washington has the data on the situation as a whole warranting the order.

Prominent officials in various companies have been interviewed and the following are typical views:

American Well Works—Three hundred men in shops in Aurora, Ill., are idle; a few in overcoats are doing bench work. The order means a 4% reduction in annual production. War orders are so mixed up with others that it is impracticable to separate them even were there time to get exemption. Electric current to test pumps for land reclamation furthering food production has been denied. The company is glad to comply with Government requests.

C. F. Lang, president of the Lakewood Engineering Co., Cleveland, says: "The end justifies the means. I feel that a real necessity existed for relief from congestion of shipping and railroad transportation. Products representing six months' output of our company, all essential for war purposes of the Allies, are waiting for ships to transport them to Europe. The order will give a much needed relief."

George R. Brandon, vice president of the Whiting Foundry and Equipment Co., indicated that war orders for cranes did not exempt his company and the state fuel administrator would make no ruling. By the time Washington can pass on the request the five days period will be up. "On the whole," Mr. Brandon said, "the order is the best thing that could be done. Production has been so far in excess of transportation facilities recently that only one-fifteenth of our output has been shipped out, so there is no use to pile up production further. We will be satisfied if no more drastic action than this one has to be taken."

A. C. Wilby, assistant to the president, Universal Portland Cement Co., says: "Our Buffington plant is shut down completely, and one thousand of our men have been turned over to the Elgin, Joliet & Eastern R.R. to remove snow and ice from Kirk yards. I believe that cement plants generally will be closed, except possibly wet plants, which obtain clay from under water."

F. K. Copeland, president of the Sullivan Machinery Co., says: "Only coal-mining machinery department is running. This represents about 50% of the output of our plant at Claremont, N. H. While there are many irregularities, I believe that the speed in putting order into effect was warranted, for any discussion or attempt at further exemptions would have delayed the remedy until too late to be of value. Now it will help out transportation and curtail over-production. Nobody is seriously hurt. Extra work at cleaning up plants is given to helpers and common laborers."

Government Contracts No Bar to Closing in Milwaukee

Milwaukee, Wis., Jan. 21.—The shutdown was general in Milwaukee, despite the fact that many of the big industries were making equipment essential to the Government on the so-called war industries.

Pawling and Harnischfeger Co. closed down entirely for five days. They kept a small force engaged on repairs and overhauling the plant Friday and Saturday. No modification of the order was received. They report that the fuel saving is very small and hardly justified, when consideration is given to the importance of urgent Government contracts on hand.

Cutler-Hammer Co. shut down Thursday night for the full period. There is a possibility that some departments executing important naval contracts will resume Monday on exemptions. The company states that the closing order is cheerfully complied with as a war measure.

The Chain Belt Co. suspended work Friday for five days, but retained a small force for urgent maintenance and supervisory duties. The others were laid off without pay. Important contracts are being held up but the closing order is regarded as probably necessary, although not wholly advisable.

The Bucyrus Co. reports that the plant is entirely closed. A few departments are expected to resume Monday to hasten work on Government contracts.

Koehring Machine Co. stated that they had no hesitation in closing as work is rather slack because of the restriction of building operations everywhere.

Philip Koehring declared that the order was "rather unpatriotic in so far as it threw many out of employment and wages."

Cleveland Plants Shut Down Despite Important War Orders

Cleveland, Ohio, Jan. 21—Melvin Pattison, General Manager of the Brown Hoisting Machinery Co., says, "The situation was so acute that something had to be done. I believe that the people in Washington were in a better position to size up the situation and apply a remedy than were the people in this or any other section of the country.

"Traffic conditions were so bad, anyway, that is was only a question of a few days until plants would have begun to close down without any orders.

"I am not saying that the situation could not have been averted by proper methods and foresight, but I do say that it was acute, and drastic measures were absolutely necessary.

"Our works, employing twelve hundred men are idle, except for one hundred men busy unloading material and doing all possible to relieve the car shortage. Our company is engaged on government work."

Charles Lang, President of the Lakewood Engineering Co., is out of town, but sent orders that the fuel order should be complied with, both in letter and in spirit. The superintendent and other officials state that six hundred men are idle on Government work.

E. W. Kaltenbach, President of the McMyler Interstate Co., said, "We have orders to work. The fuel order will not affect us at all, consequently I am not in position to comment on it." Twelve hundred men are employed in this plant.

Edwin S. Church, President of Wellman Seaver Morgan Co., said, "We have sixteen hundred men idle, but we take it for granted that the officials in touch with the general situation know best how to deal with it. We are working on Government contracts and expect to have permission to continue work soon."

$3,250,000 Loss in Wages Is Estimated for Detroit's Industrial Workers

Detroit, Mich., Jan. 21.—Detroit industrial plants generally, except those exempted, are complying literally with the Federal Fuel Administration's closing regulations. It is estimated that 230,000 workers are idle for four days, involving loss in wages alone of more than $3,250,000.

"We are completely closed, although we have some government orders," says John G. Rummey, president of the Detroit Steel Products Company.

"We have received no reply to our request for permission to operate and were we to receive an answer now it would be too late to get the men back at work."

The company employs about 1 000 men, its government contract includes large orders for steel windows for the new shipyard buildings and for buildings added to old plants. Orders for springs for ambulances and trucks for war use are also in the plant.

"Except for the aeroplane motor department we are all shut down," says Alvan MacCaulcy, president Packard Motor Company, which has large government orders.

"About 7000 of our men are idle and approximately 2000 at work on the continuation of operations in the aeroplane motor department." This aeroplane work, Mr. MacCauley explained, requires the use of nearly every part of the company's enormous plant, excepting the forge and foundry departments.

"We have been working on some Government orders," says Ralph M. Dyar, secretary of the Trussed Concrete Steel Co., whose plant is located in Youngstown, Ohio. "I am not sure the closing order affects us, but I would not care to make any statement on that plan."

Industrial Works Stops and Starts Again

Bay City, Mich., Jan. 21.—Upon receipt of instructions we shut down completely immediately. We took the matter up with the Shipping Board, and after a shutdown of 24 hours were instructed to resume operations. However, by this shutdown of one day, our organization was seriously disrupted and disproportionate delay in building Government needs was caused. A shutdown of one day per week in the future would doubtless have a similar effect. Our workmen were greatly disappointed at losing time just now.

(Signed) INDUSTRIAL WORKS.

Bay City, Mich., Jan. 21.—All plants without special exemption are complying with fuel shutdown order. Plants using power from the Consumers' Power Co. are not exempted here, as 60% of that power depends on coal. Those plants exempt are working on Government material orders or they are wood-working plants using sawdust or manufacturing wood for sale as fuel.

(Signed) MICHIGAN PIPE CO.

Electric Power Keeps Wheels Turning at Niagara Falls

Niagara Falls, N. Y., Jan. 21.—Inquiry among the Niagara Falls manufacturers shows that this district is not so greatly affected by the fuel shutdown as is the case where coal is the chief or only dependence for power. Many industries report that they have so much hydro-electric power available that they are wholly unaffected except where coal has to be used for heating. It appears that the fuel crisis is likely to be used as an argument for more Niagara power in order to make this industrial center entirely independent of coal.

President John Dobbie, of the Dobbie Foundry and Machine Co., states that his company is complying with the fuel order, but has not been obliged to lay off more than 60% of the force and hopes to resume on Wednesday at full capacity. So much of the power in this plant is obtained electrically that the matter of coal supply is a somewhat minor one. The company is making goods that are needed, and so all effort will be made within the spirit of the order to keep active as far as possible. At the same time there is no thought of evading the order in any way.

NEED MORE NIAGARA POWER

D. E. Dunlap, of the International Acheson-Graphite Co., reports much in the same vein. The company's works is using so much hydro-electric power that it is easy to comply with the order without reducing operations to any great extent. There was no idea of evading the order and only such an amount of coal would be used as was necessary to keep the needed heat up. The situation brought out clearly the need for more Niagara power, and it was felt that every effort should be made to obtain the needed legislation. If the country had a liberal supply of hydro-electric power it would be in a very independent condition.

An official of the Electro-Bleaching Gas Co., makers of liquid chlorine for water purification, expressed the opinion that his output is exempt from the operation of the fuel order, though this does not excuse him from cutting down the use of coal as much as possible. In consequence, the use of coal was restricted to the amount needed to keep the works from freezing.

Some of Philadelphia's War Industries Reopen on Orders from Washington

Philadelphia, Jan. 21.—Most of Philadelphia's big iron and steel industries were deemed essential to war work and were kept in operation. Some of those which were not exempted on the first list were later notified by Washington to resume operations. Out of 400,000 men who were made idle by the coal-closing order Friday, 100,000 were returned to work.

Baldwin Locomotive Works remained in operation. An early report failed to show the name of the big locomotive plant on the exemption list. This led to inquiry on the part of the State Fuel Administrator, who discovered that Washington had notified Baldwins of their exemption but had failed to announce the fact publicly.

The J. G. Brill Co. and the Link-Belt Co. were both omitted from the exempted list. Charles Biddle, of the Brill plant, pointed out to the State Fuel Administrator that the company was working for the Ordnance Department as well as the Navy Department. The plant was permitted to remain in operation to work on the Ordnance Department contract only.

The American Bridge Co., which was ordered to close its Philadelphia plant, asked permission to start fires under the boilers Tuesday in order to have the plant ready for operation Wednesday. Permission was refused. The plant will therefore be shut down six days instead of five.

The Hess-Bright Manufacturing Co. resumed operations today, after a three days' shutdown. They promptly observed the closing order, but were notified by Washington to reopen. Eighty per cent. of their output is going to the Government.

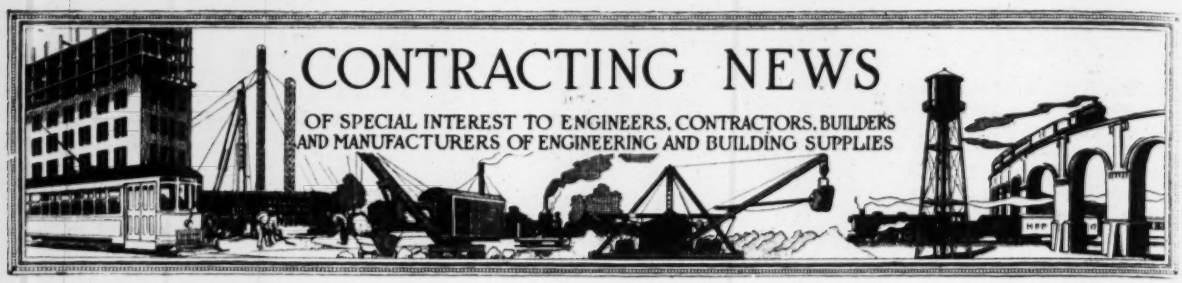
Ball Engine Co. Saves Twenty per Cent. of Fuel at Sacrifice of One Hundred per Cent. Production

Erie, Pa., Jan. 21.—The Ball Engine Company has just finished a large contract for engines for the Government, and has no Government work in the shop at present. The plant is shut down completely, in compliance with the Government order.

As five or six large plants in Erie have received exemptions from the order and are allowed to keep running and every one of them is advertising for men, some of the factories which have been compelled to close complain that they have already lost a considerable number of men.

The total saving of fuel that was effected by the shutdown of the plant was only about 20%. Normally the heating is done by means of exhaust steam, and when steam must be kept up to prevent the sprinkler system from bursting, the fuel saving is only 20%. The production loss which enables this saving is, of course, 100%.

(Signed) BALL ENGINE CO.


CONTRACTING NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

Proposals

For Proposals Advertised See Pages 59 to 61 Inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
Jan. 26.	Elizabeth, N. J.	Jan. 17
Jan. 28.	Columbus, O.	Jan. 17
Jan. 28.	Red Fork, Okla.	Jan. 24
Jan. 31.	Peoria, Ill.	Jan. 17
Feb. 5.	Jersey City, N. J.	Dec. 27
Feb. 7.	San Rafael, Cal.	Jan. 24
Feb. 10.	Janesville, Wis.	Jan. 24
Feb. 13.	Pine City, Minn.	Jan. 24
Feb. 14.	Wilton, N. D.	Jan. 24
Feb. 19.	Hartford, Wis.	Jan. 24

SEWERS

Jan. 31.	Marcus, Ia.	Jan. 24
Feb. 1.	Toledo, O.	Dec. 13
Feb. 5.	Phillipsburg, N. J. Adv. Jan. 3, 10, 17 and 24.	Jan. 3
Feb. 5.	Texarkana, Tex.	Jan. 17
Feb. 6.	Twin Falls, Idaho	Jan. 10
Feb. 14.	Wilton, N. D.	Jan. 24

BRIDGES

Jan. 28.	McCook, Neb.	Jan. 3
Jan. 30.	Dundee, Ill.	Jan. 17
Jan. 31.	Dyersville, Ia.	Jan. 17
Jan. 31.	Romney, W. Va.	Jan. 10
Jan. 31.	Dubuque, Ia. Adv. Jan. 24.	Jan. 24
Feb. 4.	Marshalltown, Ia.	Jan. 24
Feb. 19.	Princeton, Minn.	Jan. 24

STREETS AND ROADS

Jan. 28.	California	Jan. 17
Jan. 28.	Huntington, W. Va.	Jan. 24
Jan. 31.	Key West, Fla.	Jan. 10
Jan. 31.	Tacoma, Wash.	Jan. 24
Feb. 1.	Cincinnati, O.	Jan. 17
Feb. 4.	Sacramento, Cal.	Jan. 24
Feb. 4.	Greenfield, Ind.	Jan. 24
Feb. 4.	San Bernardino, Cal.	Jan. 24
Feb. 5.	Stockton, Cal.	Jan. 24
Feb. 5.	Tallahassee, Fla.	Jan. 17
Feb. 5.	Indiana	Jan. 17
Feb. 5.	Visalia, Cal.	Jan. 24
Feb. 5.	Ft. Pierce, Fla.	Jan. 24
Feb. 11.	Bradentown, Fla.	Jan. 24
Feb. 14.	Evening Shade, Ark.	Jan. 17

Bids Close		See Eng. News-Record
Apr. 23.	Santa Domingo, West Indies Adv. Jan. 24.	Jan. 24

EXCAVATION AND DREDGING

Jan. 29.	Walker, Minn.	Jan. 10
Jan. 29.	Sibley, Ia.	Jan. 17
Feb. 2.	Brainerd, Minn.	Jan. 24
Feb. 5.	Albany, N. Y. Adv. Jan. 17 and 24.	Jan. 17
Feb. 5.	Piggott, Ark.	Jan. 24
Feb. 5.	Yankton, S. D.	Jan. 24
Feb. 9.	Elbow Lake, Minn.	Jan. 24
Mar. 1.	Newcastle, Wyo.	Jan. 24

BUILDINGS

Jan. 28.	Prairie View, Tex.	Jan. 24
Jan. 29.	Fresno, Cal.	Jan. 17
Jan. 31.	Albany, N. Y. Adv. Jan. 17 and 24.	Jan. 17
Feb. 1.	Painesville, O.	Jan. 24
Feb. 5.	Nevada City, Cal.	Jan. 24
Feb. 5.	Hightstown, N. J.	Jan. 24
Feb. 11.	Columbus, O.	Jan. 17
Feb. 11.	Columbus, Neb.	Jan. 24
Feb. 13.	Des Moines, Ia.	Jan. 24
Feb. 15.	Duluth, Minn.	Dec. 27
Feb. 15.	North Elba, N. Y.	Jan. 24
Mar. 1.	Wassau, Wis.	Jan. 17
Mar. 8.	Rice Lake, Wis.	Jan. 17
Apr. 1.	Springfield, Mass.	Jan. 17

FEDERAL GOVERNMENT WORK

Jan. 26.	Rope, Concrete Mixers and Portable Saws — Wash., D. C.	Jan. 24
Jan. 28.	Boiler Shop—Wash., D. C.	Jan. 24
Jan. 28.	Plumbing Fixtures—Philadelphia, Pa.	Jan. 24
Jan. 28.	Post Office—Sunbury, Pa.	Dec. 6
Jan. 28.	Marine Railways—Boston, Mass.	Jan. 10
Jan. 28.	Marine Railway—Charleston, S. C.	Jan. 10
Jan. 28.	Gates—Louisville, Ky. Adv. Jan. 10, 17 and 24.	Jan. 10
Jan. 31.	Wharf—Ft. Adams, R. I. Adv. Jan. 10, 17 and 24.	Jan. 10
Feb. 1.	Dredging — New Orleans, La. Adv. Jan. 10, 17 and 24.	Jan. 10
Feb. 2.	Railroad Track Scales, etc. —Panama	Jan. 24
Feb. 4.	Dredging—Norfolk, Va.	Jan. 24
Feb. 5.	Excavators—Denver, Colo.	Dec. 27
Feb. 6.	Post Office — Pittsburgh, Pa.	Jan. 10

Bids Close		See Eng. News-Record
Feb. 9.	Wicket Irons, etc.—Louisville, Ky. Adv. Jan. 24.	Jan. 24
Feb. 11.	Dredging—New York, N. Y. Adv. Jan. 17 and 24.	Jan. 17
Feb. 11.	Piping System — Philadelphia, Pa.	Jan. 24
Feb. 11.	Electrically Driven Capstans—Washington, D. C.	Jan. 24
Feb. 11.	Power Plant Improvements —Brooklyn, N. Y.	Jan. 24
Feb. 15.	Dredging—Seattle, Wash.	Jan. 24
Feb. 25.	Gymnasium and Store House — Pearl Harbor, Hawaii	Jan. 24

MISCELLANEOUS

Jan. 29.	Waterway Improvements—West Palm Beach, Fla.	Jan. 10
Jan. 29.	Street Lighting System—New York, N. Y.	Jan. 17
Jan. 29.	Deepening Channel —Albany, N. Y.	Jan. 24
Feb. 11.	Harbor Improvement—Mobile, Ala.	Dec. 27

Where name of official is not given, inquiries should be addressed to City Clerk, County Clerk or corresponding official.

WATER-WORKS

Proposed Work

Mass., Westfield—Town plans to build storage reservoir on Granville water shed. A. Hyde, city engr.

N. J., Matawan—Boro. plans to install electric pumping machinery at water-works plant.

N. J., Netcong—City plans to build new pumping station for water system.

Pa., Glassport—City having plans prepared by L. Hudson, engr., House Bldg., Pittsburgh, for water system.

Ga., Dublin—City voted $15,000 bonds for water and sewer mains. M. J. Gutyon, supt. Noted Nov. 22.

Ga., Savannah—City plans to purchase electric pump for water department. About $7500.

Ill., Galesburg—City election soon to vote on bonds to improve water system, involving sinking deep well and purchasing pumping apparatus. F. M. Connolly, city engr.

Wis., Menomonie—City plans to improve water system by building filtration plant. About $50,000. P. Huntington, city engr.

Wis., South Milwaukee—City having plans prepared by Caldwell Eng. Co., engrs., Jacksonville, building additional pumping engine for water system.

Ia., Ft. Dodge—City plans to install filtration plant. C. H. Reynolds, city engr.

Ia., Marshalltown — City soon receives bids for 3 new boilers for pumping station. W. H. Steiner, city engr.